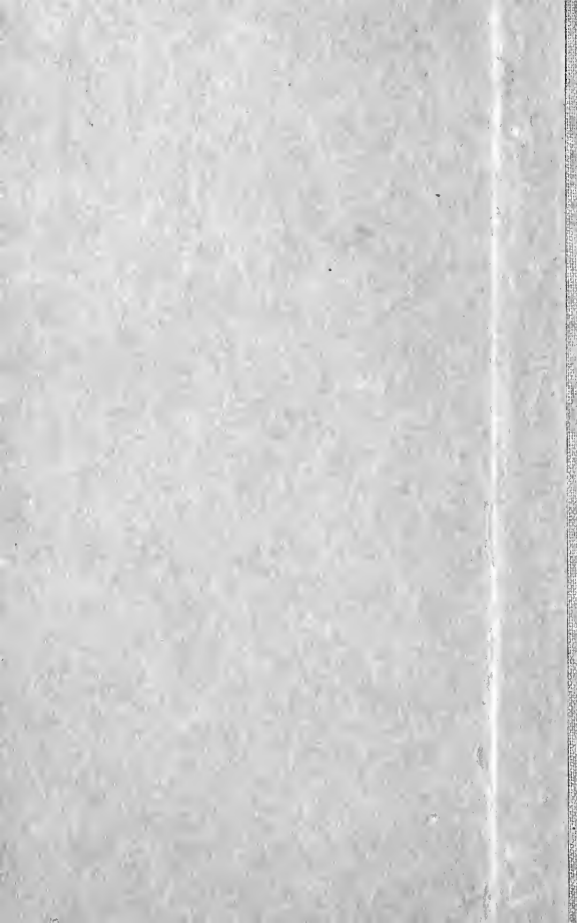


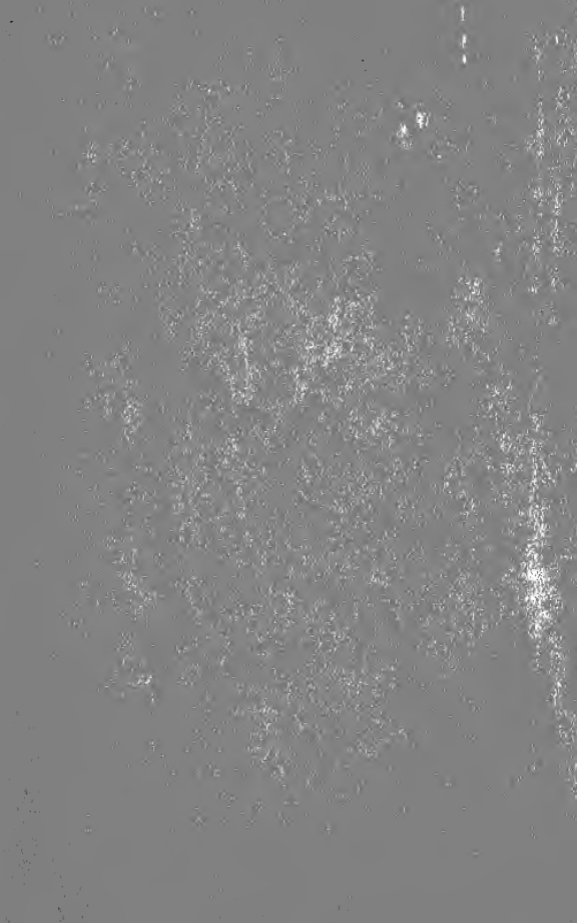
NYPL RESEARCH LIBRARIES



3 3433 07207615 5



MF
TABLE







THE NEW YORK
PUBLIC LIBRARY

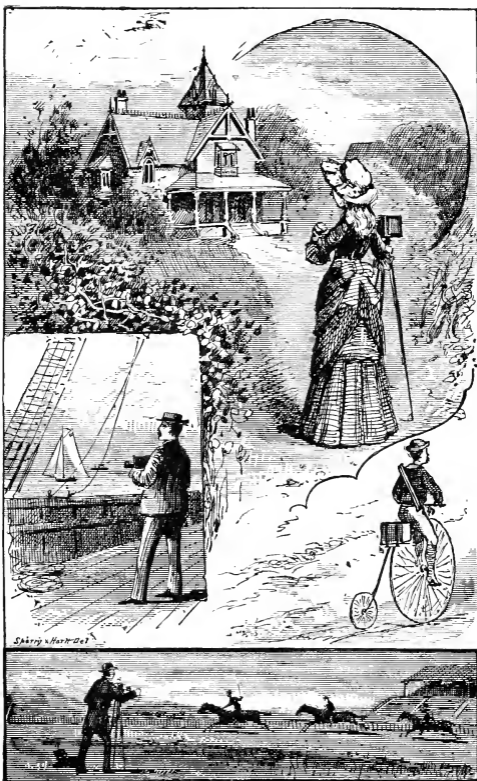
ASTOR, LENOX
TILDEN FOUNDATIONS

Tapley
MFE

Digitized by the Internet Archive
in 2008 with funding from
Microsoft Corporation

THE NEW YORK
PUBLIC LIBRARY

ASTOR, LENOX
TILDEN FOUNDATIONS



Sherry & Hart Del.

THE NEW RECREATION

AMATEUR PHOTOGRAPHY:

A PRACTICAL INSTRUCTOR

BY
D. J. ^{Tapley} TAPLEY

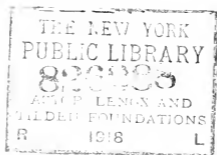
"The wayfaring man, though a fool, shall not err therein."

—ISAIAH

NEW YORK
S. W. GREEN'S SON
69 BEEKMAN STREET

1884

m. n.



COPYRIGHT, 1884,
By CHARLES M. GREEN.

THE CHAS. M. GREEN PRINTING CO.,
74 AND 76 BECKMAN STREET,
NEW YORK.

PUBLISHER'S PREFACE.

WE offer to the public this new book on Photography with a view to supplying the recognized want of a large class of amateurs. The author has, we believe, succeeded in making it readable as well as instructive, and its directions are given in simple language, free from abstruse technicalities and easily within the comprehension of the unprofessional reader. The author is a practical and successful worker in this field of art, and, as he is self-taught, he knows just what obstacles are in the path, and what instructions are necessary to assist others in self-teaching.

There are many features which will be new to the general reader, which are presented and illustrated, as we believe, intelligently, and which will be read

with interest. We have taken especial pains in the preparation of the diagrams, illustrating points which are either omitted in other similar works or simply stated without explanation.

.

AUTHOR'S PREFACE.



WE believe it is customary for an author to offer some sort of apology to a long-suffering public for the perpetration of a book, and we cheerfully conform to what is, no doubt, a wise and becoming practice.

In writing this little work we have been influenced by a variety of feelings, prominent among which is the dim hope that it may, somehow, be the inciting cause of an accretion of shekels to our bank-account.

We have not intended it as a moral or religious essay, and we shall be surprised if it turns out to be. If any one of our readers finds that by its perusal a higher ideal of duty is inspired—if he feels his life made purer and better, his spiritual longings satis-

fied and his soul sort of lifted up like—we shall be agreeably disappointed.

If, however, the study of this book shall be found to create a new love of art in its best forms, and a new admiration of the wealth of beauty with which nature has everywhere adorned her work, and especially if the book sells well, we shall feel that our labors have not been altogether in vain.

CONTENTS.

	PAGE
CHAPTER I.—THE NEW RECREATION.....	9
It Makes the Old Young—Photography for the Boys—A Word to Parents—A School of Culture—Healthful Exercise—Fun in It—Lucre in It—Photography for the Ladies—Our Plan.	
CHAPTER II.—“WET” AND “DRY” PLATES.....	23
The Wet Plate—Gelatine Dry Plate.	
CHAPTER III.—APPARATUS.....	27
The Camera—The Tripod—The Lens—The Plate-Holder—The Focusing Cloth.	
CHAPTER IV.—THE BETTER CLASS OF APPARATUS.....	36
Features of the Best Cameras—The “Rising Front”—The “Swing Back”—Folding Bed—Special Features—Rochester Optical Co.—The Blair Tourograph Co.—Scoville Manufacturing Co.—E. & H. T. Anthony—G. F. E. Pearsall.	
CHAPTER V.—SELECTION OF THE SUBJECT.....	45
Architecture—Portraits—Fortunate Accidents—“Actinic” Colors—Landscape—General Remarks—Practice <i>vs.</i> Precept.	
CHAPTER VI.—SYNOPSIS OF PROCESS.....	56
Developing the Negative—The Negative—Making the Print—Toning—Fixing—Mounting.	
CHAPTER VII.—SECURING THE NEGATIVE	59
Getting Ready—The Red Lantern—Filling the Plate-Holder.	
CHAPTER VIII.—THE START.....	63
Setting up the Camera—Focusing—The Exposure—Our First Negative.	
CHAPTER IX.—DEVELOPING THE NEGATIVE.....	71
Ferrous-Oxalate Development—Formulas—Preparing the Developer—Developing—Amateur’s Record Blank—Pyro Development—Chemicals—Intensifying Negatives.	

CHAPTER X.—FIXING AND VARNISHING.....	83
Fixing—Varnishing the Negative.	
CHAPTER XI.—PRINTING.....	89
Making “Blue Prints”—Printing—Mounting—Trimming— Pasting.	
CHAPTER XII.—MAKING SILVER PRINTS.....	94
Fumigating—Printing—Toning—Mixing the Toning Bath— The Toning Bath—Fixing—The Fixing Bath—Mounting—Spot- ting—Burnishing—Printing Clouds—Masking.	
CHAPTER XIII.—PORTRAITS.	102
Out-door Groups—In-door Portraits—Mirror Portraits—Vi- gnetting—Medallion Printing—To Draw an Oval—Re-touching.	
CHAPTER XIV.—INTERIORS OF HOUSES.....	110
CHAPTER XV.—PHOTOGRAPHIC TRANSPARENCIES.....	112
CHAPTER XVI.—INSTANTANEOUS PICTURES.....	114
CHAPTER XVII.—STEREOSCOPIC PICTURES.....	118
Photo-Micography.	
CHAPTER XVIII.—LENSES.....	120
Rectilinear Lenses—The “Focus”—“Depth of Focus”—Stops —A Partial Remedy—Averaging the Focus—Focusing with Clear Glass.	
CHAPTER XIX.—HOME-MADE APPARATUS.....	130
Printing—Frames—Changeable Stops.	
CHAPTER XX.—FAILURES.....	135
CHAPTER XXI.—GENERAL HINTS.....	138
CHAPTER XXII.—DEFINITIONS.....	139
CHAPTER XXIII.—NEVER.....	141
CHAPTER XXIV.—WEIGHTS AND MEASURES.....	142

The New Recreation



MR HERBERT SPENCER thinks that we Americans do not have recreation enough. We are too much occupied with the perpetual grind of business, and too apt to neglect the duty of cultivating the finer instincts of our being, and of keeping our muscles, brains

and nerves in such a state of robust, rollicking health as should make us endurable to ourselves and a source of happiness and inspiration to others.

I am inclined to think that Mr. Spencer is right.

If we assume the correctness of the diagnosis, it follows that the man who invents a new recreation and makes it popular (as, also, the ingenious artisan who furnishes the equipment by the instrumentality of which the fun is evolved, and

the publisher who disseminates a knowledge of its methods, making its mysteries as plain as the light of day and its manipulations as easy as rolling off a log) becomes at once a great public benefactor.

I am also disposed to believe that this conclusion is correct.

Amateur Photography is not only the *best* of all recreations, but it is rapidly becoming the most popular. As soon as the people comprehended the idea that the making of beautiful pictures was practical for anybody and everybody, and especially when it became possible to buy for a few dollars the whole outfit for the pursuit of this new pleasure, it was taken up by hundreds and thousands who had known nothing of the art before, but who are now skilful photographers.

The process of making pictures by photography has been regarded as a particularly occult and mysterious one, which required a special gift and years of study under the instruction of a professional. That was the way it looked to me. After a few months of practice, with no instructor except a book furnished with a cheap outfit, I have succeeded in making pictures that are a source of satisfaction to myself and friends, and that I am willing to compare with those of the average professional.

The intelligent reader who has analyzed my work to this point will concede that I am not specially gifted and, as a logical sequence, that, if *I* can succeed, *any one can*.

It Makes the Old Young.

I have learned this new trick in spite of the difficulty of being an old dog and not so apt as my young and middle-aged readers.

I am fifty years old. To be concise, I was just forty-nine on the 22d of last February—the eminent George W. and myself having been born at the same inclement season of the year. It would naturally be supposed that the enthusiasms and follies that inhere in adolescent manhood would be nearly outgrown by this time, and in point of fact they are.

In my boyish days I had achieved a variety of small successes in an experimental way. I had built a foot-lathe, and its first revolution gave me a thrill of ecstatic bliss which another half century will not obliterate from my memory. I had constructed an electric machine, and remember its first spark, as well as the first successful rocket or wheel evolved by my chemical laboratory in the old shoe-shop.

But those days are past, and I long ago had set-

tled down to the belief that I should never again feel the triumph of such proud achievements, when I happened to hear of the new recreation, and I have found that amateur photography is the magic art which brings back a renewal of the sensations which I had supposed to be gone—past recall. The old love of art is revived again, as I tramp about in pursuit of beautiful subjects in landscape or architecture, and every tree, or cloud, or sheet of water has a new meaning to me. The trembling shadows of foliage upon the lawn—the flowers, from the anemone and arbutus that peep through the snow in early Spring to the golden rod and purple aster that make the wane of the year glorious—the Autumn tints of woodbine and maple—have each taken on an added beauty, brighter even than my young eyes perceived so long ago.

My sensations during the development of a plate are precisely like those excited by the chemical experiments of my boyhood, and I watch the gradual growth of the picture from the flat surface of the film with breathless interest and the old delight which I had supposed forever unattainable to me; the process is exquisitely beautiful, and one never seems to tire of it.

If any of my readers finds himself getting *blasé* and dissatisfied with ordinary recreations, let him try amateur photography.

Photography for the Boys.

There is nothing on earth that a properly appointed boy finds such exquisite enjoyment in as in the learning and doing of something *new*. The complaint of some older people that their boys tire of a thing as soon as they have fairly learned it, which is, no doubt, often true, is simply rebellion against a wise decree of Providence, which impels the young mind to educate and inform itself in the direction in which it is most ignorant. It is this tendency to search out and explore every *terra incognita* which gave America, for instance, to the world. Where would *we* be, if Columbus had been satisfied to stick to the wool-combing that his Genoese father affected? Evidently, nowhere.

There is no better practical education for a boy than that which he acquires in the construction of kites, tops, water-wheels and wind-mills, before he is ten years old. As he gets bigger the same tendency finds expression in the manufacturing of brackets and other articles of Sorrento work on the scroll-saw, the building and equipment of a miniature mill to be operated by his water-wheel, or even the construction of that crowning mechanical triumph—a steam engine.

Or, possibly, the instinct for art may be born in

the mind of the boy, and its development will exhibit itself in pictures upon the slate, then upon paper, and finally upon the canvas that graces the walls of the Academy and makes its author famous. When *I* was a boy at school, I used to devote a considerable portion of my time to the drawing of caricatures of the school-master and my fellow pupils.

As I look back, I can see that it afforded me something better than mere amusement. It was a part of my education. I can recall the feeling of exquisite satisfaction which I experienced when my mother bought for me a box of paints and a stock of drawing-paper and pencils. Through all her life she was the very best of mothers, but the memory of that one gift has done more to keep alive the gratitude I feel toward her than all her years of constant love and kindness.

A Word to Parents.

If this chapter should reach the eye of a parent of one of my young readers, I would like to impress this fact upon him or her—that the cords of love that bind your boy to you, and the moral grip that you may use for leading him in all right ways and holding him back from whatever is wrong, can be strengthened in no other way so effectively as

by encouraging in him the particular instinct—for art, mechanics, literature, or whatever else is good and useful—that he naturally follows.

A School of Culture.

You will find then, boys, that photography meets and satisfies the requirements of a perfect recreation more fully than anything you have yet taken hold of.

It cultivates the instinct and taste for art and leads to a study of what is most lovely in nature. The search for the beautiful leads to a new love and appreciation of the beautiful. The gold and crimson tints of sunset were never so gorgeous before, simply because you have not studied them. The grand, shady arches of the forest; the flowers, gleaming in the sunshine or hiding in the shadows; the mountain brook, gliding among the ferns and mosses, or dashing with noise and fury over the rocks—are seen to possess a charm which, till now, was undiscovered, and each yields a new lesson in form and motion.

The far-off blue of heaven, broken by fleecy clouds; the shadowy tints of the distant hills; the green of lawn and forest in Spring time and the sober brown of Autumn; the ice-covered forest boughs, glittering in the winter's sun like jewels in

the crown of royalty, have gained a richness of harmony or contrast in color that were before undreamed of, and all nature has become a school of refinement and culture.

Photography also satisfies the mechanical taste and offers plenty of opportunities for its exercise. The manipulation of the camera is a study in itself, calling for the practice of care, judgment, and patience.

By the study of buildings the amateur becomes familiar with the methods and details of architecture; and in the making of shelves, negative racks and dozens of other accessories, which are convenient, if not absolutely necessary, the hand becomes accustomed to the use of tools.

A sufficient smattering of chemistry to inspire a wish for more will be acquired by the mixing and handling of chemicals used in the developing of negatives and the printing and toning of pictures.

Healthful Exercise.

The long tramps over the highways and across lots in pursuit of choice bits of scenery, landscape and skyscape, picturesque ruin or elegant villa, afford the temptation and excuse for athletic exercise of the most healthful sort.

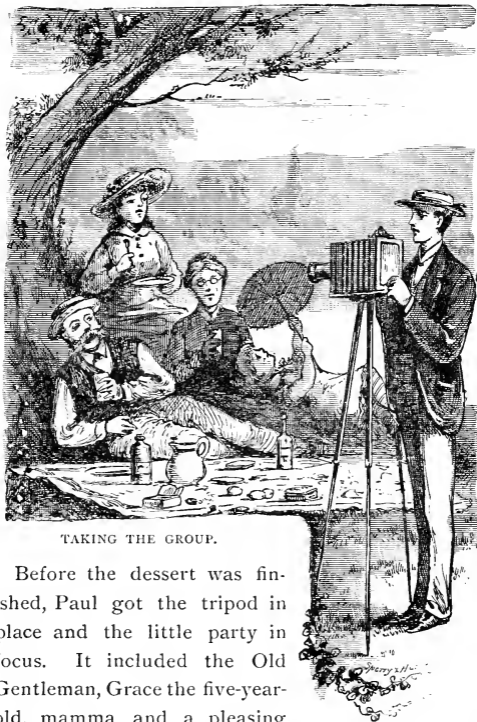
What splendid times my boy and I have had on

the march and in the field of action! What appetites we have brought to the discussion of the lunch which had filled the surplus space in the "carrying case"! Nothing could be more cheerful and exhilarating, or more conducive to the serene good nature which is at once the cause and effect of a perfect digestion.

Fun In It.

Again, just think what fun it would be, and how much it would add to the satisfaction to be derived from the memory of a trip in the country, or a vacation of a few weeks, if you could take the camera along, and in addition to the new pleasure of hunting up and capturing the nice bits of landscape, you could have the triumph of exhibiting—all the next Winter—the trophies of your taste and skill and the best illustrations of the wonderful stories you might tell of stirring adventures, famous exploits, or strange mishaps.

I remember a beautiful day last Summer when we took the cars, a lunch-basket and the camera, to spend a day at Prospect Park. After rambling about and having a jolly time, including the taking of fine negatives of the lake, the boat-house, etc., we spread a tablecloth on the grass, and covering it with dishes, napkins, eatables and drinkables, we sat or lay down to a well relished lunch.



TAKING THE GROUP.

Before the dessert was finished, Paul got the tripod in place and the little party in focus. It included the Old Gentleman, Grace the five-year-old, mamma, and a pleasing young person of the *genus* schoolma'am. The *pose* of the party was careless, if not picturesque, and, at the command, we "held still" until the group

was transferred to the sensitive surface of one of the dry-plates. The resulting picture brings back the full enjoyment of our day's outing every time we look at it.

In our illustration both Paul and the O. G. are represented as about to take something.

If you dabble in oil or water colors, the camera will give you absolutely perfect drawing and perspective of whatever is worth painting, or any suggestive bit you may wish to save.

Lucre In It?

There is even money in it. You will find that the prints you make of familiar objects about town, or famous things at a distance, will sell to your neighbors at a nice profit.

I have a negative of the East River Bridge and several others, for which there is a constant demand at a good price. Some of your neighbors who have fine places will also want you to make photographs of them; and a favorite horse or dog, or a fine Jersey cow or calf are quite as likely to prove profitable subjects for your art.

The thing is as easy as can be. Since the introduction of "dry plates," of which I will tell you later, the whole matter is simplified to such a point that any boy or girl of fair common sense who will

read this book can succeed in making good pictures, by using a little care and patience and doing the *best* possible every time.



NO ASSISTANCE NEEDED.

Photography for the Ladies.

Amateur Photography has become a very popular amusement with the ladies, and the ranks in-

clude a large number of enthusiastic and successful artists of the gentler sex. With the new plates and process there is but little weight to carry, no chem-



"BARKIS IS WILLIN'."

icals to soil the fingers, and no obstacles to the fullest enjoyment and success. A party exclusively of ladies can manage the whole business without any

trouble, but if, as is barely possible, a sprinkling of the "feller critters" should be thought desirable, we offer no objections, and we have no doubt that any number of emulators of the late Mr. Barkis could be readily found.

Our Plan.

I purpose, in this little book, to tell you just how it is done; and if you follow me through, and put in practice the knowledge with which these pages drip, you will acquire a skill and proficiency of which your friends will be proud, a love of the true and beautiful in art which will be in you a well-spring of refinement and culture, and a habit of outdoor work that will lead to health, happiness, and possibly lucre.



CHAPTER II.

“WET” AND “DRY” PLATES.

VERY few of those who have sat for a portrait and watched, with some degree of interest, the movements of the operator, who does something inexplicable under a black cloth at the rear of a box, and of the posing artist, who executes a war dance about the victim, tortures him with well meant attentions and entreats him to “look pleasant now,” have any idea of the process by which the resulting work of art is produced.

The Wet Plate.

When a portrait is to be made by the usual process, a plate of glass is coated with collodion and made sensitive to light by dipping it in the silver bath. This plate must be used while it is wet, and a good deal of care, skill, and judgment are required in the various manipulations. When it was to be used out of doors, for landscape or architectural work, it was necessary to have a dark room

on wheels, within which the plate could be prepared and placed in a light-tight slide or holder, and to which it could be returned for the "development," which must be done before the plate dried. Sometimes the traveling artist undertook to carry a portable tent and apparatus for performing these operations, and when he had got the thing down as



THE OLD WAY.

snug as possible, he looked exactly like the person whose picture we give in the margin. He had lots of trouble and frequent failures, and under the most favorable conditions could accomplish but little work.

Of course, no one of our readers would think of doing such violence to Webster and Worcester as to call this sort of thing a *recreation*. It was hard and soul-destroying labor; but the love of science, and the temptation to make a living which inheres so strongly in the human heart, occasionally induced a man to try it.

The Gelatine Dry Plate.

All this, however, has been changed by the advent of the "Gelatine Dry Plate." This is a glass

plate upon which an emulsion of gelatine is spread, and this coating is made extremely sensitive to light or susceptible of chemical change by the action of actinic rays. It needs no skillful manipulation, like the wet plate, as the care and skill have all been put into the plate itself by the manufacturer. As it can be used dry, it requires no dark tent, but any number may be carried in plate holders, "exposed," and brought home for "development" on your return, or kept for months and developed when convenient. Plates have been exposed in the Arctic regions and on the sands of Africa, to be brought home and developed months afterwards.



THE MEREST PASTIME.

The only outfit which has to be carried along in taking views is a box, containing the camera and plate holder, in one hand, and the folded tripod in the other. The view artist, with all his impedimenta, walks along in the easy, careless style represented in our cut, making the merest pastime of the whole business.

If he wants one arm free, he can arrange a strap over the shoulder to carry the "sticks" like the carbine of the cavalryman.

(In the illustration on page 21 our artist has suggested a possible, but utterly unjustifiable, use of the free arm.)

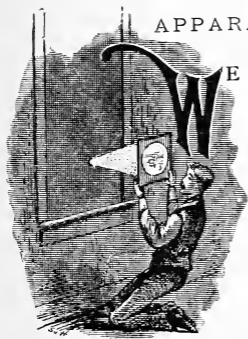
The introduction of the Dry Plate is the one step in the growth of the photographic art that makes amateur photography possible to the masses.

The new impetus which has thus been given to the art has led to a demand, and has been followed by the production of apparatus which is at once elegant, simple, compact, and capable of a wide range of the best work. A beginner can purchase an outfit for \$10 to \$25, if he chooses, for his first experiments; and as our readers may have a curiosity to know something of these cheaper outfits, we will give a description of those in common use.



CHAPTER III.

APPARATUS.



WE will illustrate our subject by an interesting and beautiful experiment.

Take a room that you can make perfectly dark—the bath-room, for instance, that has but one window—and stop up every crack through which light can enter.

Now make a round hole in the shutter, about a quarter of an inch in diameter, and when you hold a white paper behind the hole you will see simply a white picture of the hole on the paper; but move it further off, say a foot or more, and when it gets to the right point you will behold a beautiful picture of the buildings, trees, sky, or other objects outside the window. The picture

will be in the lovely colors of nature, but it will be inverted—that is, it will be bottom up, and the right will be where the left ought to be. The outlines will also be somewhat hazy and indistinct—lacking sharp definition.

Now, if you will take grandmother's spectacles, and hold one of the glasses just in front of the hole, you will find that the image on the paper becomes clear and sharp, and every detail perfectly accurate.

In this experiment you have constructed a "camera," having all the essential parts of the machine behind which the photo-portraitist hides his head under a black cloth, and in front of which the posing artist cavorts, telling you to "hold up your head a little more," and enjoining you not to wink, for your life.

"Camera" is short for *camera obscura*, which is Italian, or something, and means, simply, "darkened chamber," and your darkened bath-room answers exactly to the photographer's "box."

The spectacle glass is practically a counterpart to his lens, and the white paper is, to all intents and purposes, the same thing as his focusing screen of ground-glass. If you could put a dry plate in "focus," in just the position that the white paper occupied when the picture was the sharpest, it might be possible to make a picture

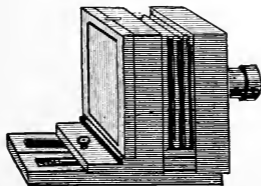
with this very primitive arrangement. Your success would be somewhat problematical, and the picture would always be the same, as you could not carry the house about, nor bring the beautiful views in your neighborhood around to be "taken."

This dilemma has been anticipated, however, by the manufacturers of photographic apparatus, and an elegant outfit of the necessary appliances can be bought for a little money, while the whole business can be learned by coming along with us in these lessons.

The apparatus for amateur work is very simple and easily described.

The Camera.

First, then, is the camera, or "box" as the professionals call it. It is constructed with a front,



THE CAMERA.

in which is fixed the lens, and a back, to which is attached the focusing screen of ground-glass,

or the plate holder. The front and back are connected by a bellows, like that of an accordeon, to keep out the light, and can be moved toward or from each other on a framework called the "bed."

The Tripod.

The camera is supported upon a three-legged stand called a "tripod."



THE TRIPOD.

The most improved style of tripod has its legs constructed so as to fold or slide together, making the length only about half of the height when standing, and occupying a space of about two and

a half inches square and two and a half feet long. I have made a nice green bag for mine, with a flap and button.

A small triangle of brass completes the top of the tripod, the legs being quickly sprung into place, and the camera being attached by a brass screw. Another form of tripod is so contrived that its legs can be extended or shortened—a facility which is of great value in some situations.

The cut shows the folding tripod, which is the lightest and most compact form in use, as well as the cheapest.

The Lens.

The particular factor of the machine, upon which its efficiency depends more than upon any other part, is the lens which ornaments the front of the box.

This is a circular piece of glass, so formed as to “refract” the rays of the light that pass through it. If you will examine the spectacle glass, you will find that it is thick in the middle and thin at the edges. This construction causes the rays of light to be bent, or *converge*, toward the centre, like the rays of heat with the burning glass, which you know all about. This point at which the rays meet

is called the *focus*, and it is here that the image is most distinct.

Upon the accurate construction of the lens depends not only the fineness of the picture, but the time of exposure. The instantaneous pictures of boats under sail, animals in motion and similar subjects, can only be made by means of a "rapid" lens, as well as extremely sensitive plates.

The lens furnished with amateur outfits is usually what is known as a "single achromatic" lens.



WIDE ANGLE LENS.



PORTRAIT LENS.

It is really made of two lenses cemented together, to correct the tendency to form edges of rainbow color around the objects seen through it. (See "Lens," page 120.) It is enclosed in a brass cylinder called the "tube," and furnished with a partition having a round hole in the centre called a "stop," the purpose of which is to make the image upon the plate sharp and distinct not only in the centre, but quite to the edges. (See "Stops," page 124.) For instantaneous work, the lens has a

spring shutter, which admits the light for not more than the twentieth part of a second, so that the ever-moving ripples upon the water, or the folds of a flag in a breeze are transfixed upon the plate just as that one flash of light caught them.

The lens in the cut is provided with a number of stops, of different apertures, which, when not in use, are carried in the neat morocco case seen in the picture.

The Plate Holder.

As the gelatine film upon the plate is extremely sensitive to light, provision is made for keeping it in the dark, except when it is temporarily exposed to the light of the image in the camera.

We give here a picture of one of the



FIG. 1.

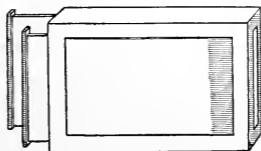
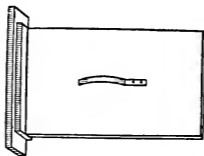


FIG. 2

most common forms of plate holder (Figs. 1 and 2), which is a box about one inch thick, having grooves

(BB) into which the plates are slid, and slides which can be withdrawn after it is in place at the back of the camera. After the exposure is made the slide



THE PARTITION.

is replaced, and the plate is once more in the dark, and can be safely carried about as before.

The Focusing Cloth.

A piece of light rubber cloth, about one yard square, is used for putting over the head, so as to shut out the outside light while focusing the picture.

This completes the list of apparatus for the exposure of the plate, which is the first step in the making of the picture. The whole outfit can be bought for ten dollars, or you can spend much more if you are so disposed, and your bank account will stand it. If you choose you can start with a small and cheap apparatus, and when you outgrow it, and your success will warrant you in buying a

larger and finer outfit, you can readily sell it for about what it cost.

In a future chapter I will describe some of the finer and more expensive apparatus.

The dealers will supply you with a full equipment, including chemicals and materials for an extended series of experiments, for a reasonable amount.



"A Fine Horse or dog"

CHAPTER IV.

THE BETTER CLASS OF APPARATUS.

WE have described the cheaper class of apparatus, but we do not necessarily advise you to buy it. The beginner can do so on commencing, if he chooses; but the uniform and inevitable result is that he outgrows it and buys a larger and better one, and the first outfit, which has, to be sure, served the purpose of initiating him, falls into disuse.

Features of the Best Cameras.

The better and higher-priced cameras, which are used by advanced photographers, are not only better made and more highly finished, but combine several important improvements which are essential for certain kinds of work, and which the price of the cheaper instruments cannot be made to cover.

The "Rising Front."

One of the most useful of these is a simple plan by which the front board, carrying the lens, can be

raised or lowered, bringing the reversed picture higher up on the plate, so that the view has more sky and less foreground. This is often necessary in order to show the top of a building or other object, and it is done by sacrificing a strip of the lawn or street in front of the camera.

The "Swing Back."

When the rising front will not give sufficient sky to your view, as in a picture of a very tall building or church steeple, it becomes necessary to aim the instrument upward. The result of this is a converging of the vertical lines of the picture toward the top, spoiling the perspective. To remedy this the back of the camera carrying the plate must be again set in a vertical position by moving the top forward, when the lines on the ground-glass will be found to be again parallel.

If the camera is pointed downward, the lines of the picture will spread towards the top, and the difficulty can be obviated by swinging the top of the camera back in an opposite direction, making it vertical as before.

Folding Bed.

In the cheaper instruments the bed is rigid, and the camera occupies much space in the carrying

case. In the better makes, the bed folds up against the camera, making a very compact and portable arrangement.

These features are common to all the best cameras.

Special Features.

There are quite a number of reputable makers of apparatus, each of whom has some special improvement which distinguishes his make of camera.

Rochester Optical Co.

The instruments of the Rochester Optical Co.



"NEW MODEL" CAMERA.

are well built, of cherry wood, and embody several valuable features. One of the most important of these is a ball-and-socket joint at the top of the tripod, by which the camera can be instantly levelled without moving the legs of the tripod. This is always convenient, and in many localities almost indispensable.

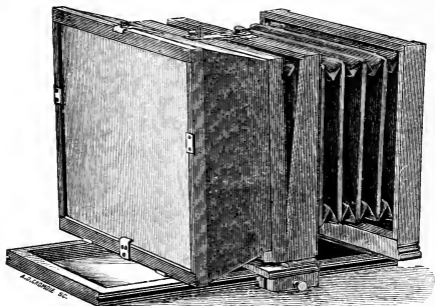
The double swing back and the device for "reversing" the camera, so as to take a vertical instead of a horizontal picture, are both ingenious and effective.

Their "New Model No. 4" Amateur Camera is of cherry, with nickel trimmings, and is provided with levelling tripod head, reversing clamp, rising front, swing back, changeable stops, hinged ground-glass and folding bed. The plate holder exposes the whole plate, and takes either a 4x5 or 5x8 without the use of "kits."

The Blair Tourograph Co.

Blair, of Boston, has invented and brought out several useful and ingenious additions to the camera. Among these is an extension at the back of the instrument, by means of which a 5x8 camera may be made to take an 8x10 picture, a $6\frac{1}{2} \times 8\frac{1}{2}$ a 10x12, etc. There is also an arrangement for attaching the plate-holder without removing the

ground-glass, which permits the plate-holder to be "reversed" for a vertical picture. The new Blair plate-holder is a marvel of compactness, the double holder being only one half inch thick. A



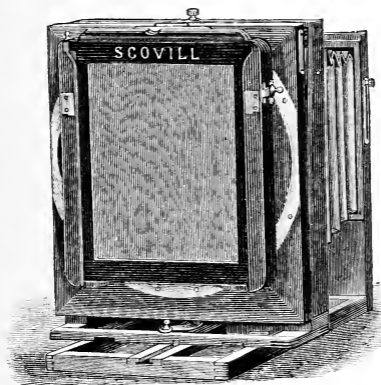
BLAIR COMBINATION CAMERA.

late holder of this house has a "kit" for exposing plates of different sizes. Another addition to the camera is an extended front, which allows the use of a long-focused lens. The best instruments from this factory are well built, of mahogany, finely finished and nickel-plated.

Scoville Manufacturing Co.

The Scoville Manufacturing Co., of New York city, are well known to photographers throughout the world, and their goods have a splendid reputa-

tion. Their catalogue embraces a large variety of instruments of all sorts and grades, a specialty being amateur outfits. A revolving-back camera for vertical, horizontal or diagonal pictures is one of their latest novelties, and a pocket camera of extreme



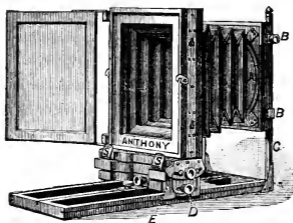
REVOLVING BACK CAMERA.

lightness and portability is a favorite with ladies and tourists. The "Daisy" plate holder is a valuable addition to the outfit of the advanced amateur.

This house has done especial service in the cause by their excellent photographic publications, which include a monthly magazine.

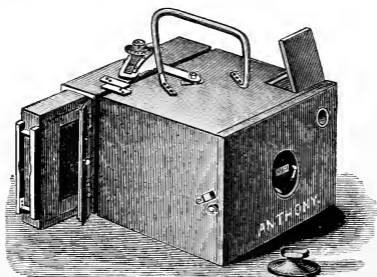
E. & H. T. Anthony.

This is an old and well known house, whose goods are in use all over the Union, and need no



THE "NOVEL" CAMERA.

indorsement here. Among a large assortment of cameras we would mention the "Novel" as one of



THE DETECTIVE'S CAMERA.

the most meritorious. It is full of ingenious and effective devices for accomplishing all that the best instruments are capable of, and its reversing ar-

rangement of a revolving front is the acme of convenience and adaptation. A "Detective's Camera" made by this house can be used to make exposures surreptitiously, securing evidence without the knowledge of lookers on. This house are dealers in the substantial and legitimate rather than the ingenious and new-fangled, and, though showing an excellent line of amateur goods, their business is mostly with professionals.

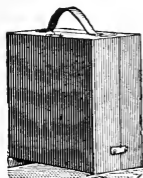
G. F. E. Pearsall.

Mr. Pearsall, a portrait artist of Brooklyn, has brought out a camera called the "Compact," which



THE "COMPACT" CAMERA.

is, perhaps, the most striking innovation yet attempted. The camera is its own "carrying-case," the front of the box turning down at right angles for the bed of the camera. It has a bellows hood for focusing (instead of the usual cloth), a rifle sight for instantaneous shots, dispensing with tripod, a



THE "COMPACT"
CLOSED.

back, forward and side swing, roller screen (in place of ground-glass), and many other new features. It is the most compact instrument made, and the readiest in manipulation.

The new Ruby plate holder is one of the best, being light-tight and very portable. The latest pattern of Compact takes single or stereoscopic pictures, and kits are arranged for a variety of sizes with the same instrument. Mr. Pearsall has recently made an ingenious adaptation of the same principle to a cheap camera for beginners.

CHAPTER V.

SELECTION OF THE SUBJECT.



AS I intimated in the first chapter, our attention as photographers will be devoted almost exclusively to outdoor work, as portraiture requires special conditions which are not likely to be realized by the amateur. The most promising subjects for your art are choice bits of scenery, with pleasant combinations of prettily contrasting foliage, mirror-like water, elegant architecture or picturesque ruins, with occasionally a portrait taken in the open air.

True success in producing pleasing pictures will depend, in a great degree, upon the selection of a subject, the point of view from which it is taken, and the time of day—or, in other words, the angle at which the light strikes it.

Architecture.

The best view of a building is one that includes a side (the front, probably) and one end. Of course you will choose the more attractive faces of the building, and take the picture from a point that gives the lines a perspective slope in two directions.

If you have studied drawing, you will be surprised at the unerring accuracy of the perspective which the camera gives, without any sort of trouble or effort.

It is better to bring the house a little to one side of the view, so that the effect will not be too set and geometrical. If you can manage to have a few large trees in the foreground, or if the house can be seen through a vista of trees, so much the better. The sun should so illuminate the view as to bring out all the projecting points by contrast of light and shadow.

For this reason it is better that the sun should shine at an angle, relieving any projecting part by a strong light on one side and a shadow on the other.

If, for instance, it was desired to show a projecting bastion, like that in the cut, in bold relief, it could be best brought out by taking it when the sun, A, shone in the direction indicated, placing the

camera at B. With this arrangement, the side (a,b) would be much lighter than the front face of the wall, and the shadow (c,d) would serve as a counter contrast upon the opposite side, the general effect being like this, in Fig. 2.

Shadows of trees across a lawn serve to bring out any inequalities of surface, and to vary pleasantly the monotony of a flat mass of green.

As a rule, it is well to avoid anything like geo-

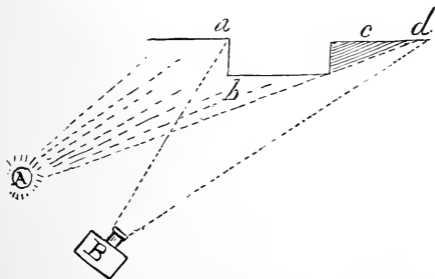


FIG. I.

metrical precision in a picture. The point of interest and the boldest foreground should generally be at one side of the centre, the perspective vanishing in the distance at the opposite side.

The view on page 49, of the Hudson, near Haverstraw, on the West Shore route, illustrates this point finely.

Do not have the sun exactly at your back, but partly to one side; for, if the lines of light from the sun and toward the camera are exactly parallel, you see no shadows. The light may shine nearly at right angles with the axis of the camera, but

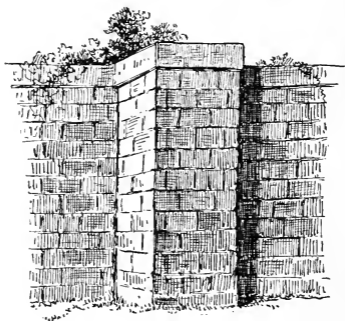


FIG. 2.

never from the front, so as to enter the lens-tube.

If the camera is aimed upward, the lines of the building will taper, or converge, toward the top; and if pointed downward, they will taper the opposite way.

This tendency must be counteracted by swinging



VIEW NEAR HAVERSTRAW.

the back of the camera until it takes, again, a vertical position.

For this reason it is a good plan, if possible, to place the camera at such a height that the upper part of your view will be included on the plate without inclining the camera upward.

Portraits.

If there are human figures to be taken with the house, try to place them so as to form a part of a properly balanced picture, sitting or standing in easy, natural positions, instead of having them look like persons who are having their portraits taken—the other features of the view being merely a background.

A person sitting in an arbor or on a rustic seat in the foreground, reading a book, or, at any rate, not looking directly toward the camera, or apparently paying any attention to it, will give life to your composition; or a party at croquet on the lawn at a greater distance will add materially to the variety of the *ensemble*.

The figure, if in the foreground, should be in the shadow, as the eyes of the sitter will not bear the sunlight, and intense light and shade would spoil the softness so indispensable to a portrait.

Fortunate Accidents.

There are two points in which the lens and the actinic effect of the atmosphere seem to help out the picturesque effect of landscape photographs. In making a near view, such as an out-of-door por-

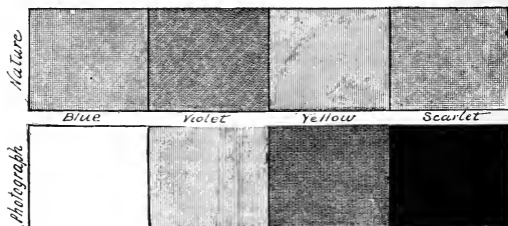
trait, in which the sitter is within, perhaps, ten feet of the camera, the figure will be sharply defined, while the objects in the background will be hazy and indistinct. This is almost precisely the effect which the "old master" would adopt to secure the prominence of his central idea, as it brings out the portrait in bold relief by contrast with the dimly defined background upon which it rests. The other point lies in the fact that a distant object requires a much shorter exposure than a near one, and the result is that in a landscape in which the objects near by are sharp and brilliant the distant hills are made soft and hazy by over-exposure, so that the most beautiful gradations of atmospheric perspective are secured.

The effectiveness of any view depends largely upon the variety of contrast which it affords. A white cottage is seen best when set off by dark foliage. An object in sunshine is best brought out against a background of masses of shadow.

"Actinic" Colors.

In making up your picture, it is well to remember that the tints of nature are not always fairly represented in the photograph. For instance, a pure blue, like that of the sky, is rich in actinic effect and shows as white in the picture, while a light

red or orange is transformed into a nearly black shade. I made a negative of my little girl the other day in which she sat among the ox-eye daisies, wearing a turkey red "Mother Hubbard," and holding a bunch of the flowers in her hand. The light-



NATURAL AND PHOTOGRAPHIC TINTS.

yellow center of the daisies, and the red dress, were black in the photograph.

The cut on this page gives a good idea of the relative depth of natural colors and of their reproduction in photographs.

Landscape.

Fine landscape work is not only more pleasing than architectural views, but more difficult. If you know of any attractive bit of landscape, view it from all points, and calculate at what time in the day the sun will light it so as to bring out its best features.

If there is foliage, take such a position that the character of each variety is brought out by contrast with the opposite; for instance, the horizontal branches and light-colored foliage of the black dogwood will be best shown by a background of the dark, vertical masses of the cedar.

A bit of brightly lighted lawn seen through the trunks of the trees, or a patch of sky above the tops, gives a pleasant contrast and prevents monotony. Always have, if you can, some strongly marked objects in the foreground—such as rough logs or rocks, and see that they are well lit up by the sun.

If the distance shows mountains or hills, their softness will afford a fine contrast in tone and character with the sharply defined objects close at hand.

A pond of still water, with reflections of trees, rocks or ferns upon its margin, or of boats upon its surface, makes one of the most pleasing views. A mountain stream with rocks and mossy logs is always beautiful, but should be taken, if possible, instantaneously, so as to catch the dash of the water and the sparkle of the sunshine.

A most beautiful effect in a landscape is imparted by a clouded sky. This feature can only be secured upon days when clouds are visible, but they are well worth waiting for. It is possible, however,

to print in clouds by means of a separate negative and a double printing—but of this hereafter.

It will always be desirable to avoid a windy day, as the movement of foliage gives a blurred and unpleasant effect, and the water, if your picture includes it, becomes ruffled, spoiling your reflections.

You will sometimes have to chop away a limb of a tree that stands too near the camera, so as to be out of the general focus and injure the effect. For this purpose a sharp hatchet will be found useful. You may even add to the balance and harmony of your composition by dragging in a few old logs or other rough objects, or setting out a clump of bushes, to vary the monotony of an uninteresting foreground.

General Remarks.

Whatever you attempt, do your best, taking pains to learn just how and when the best effects can be attained. Nature is capricious, and her varying moods develop varying beauties in the landscape. A mountain scene in a storm and the same in sunshine are two very dissimilar pictures. A photographer who is really an “amateur” who *loves* his art, will visit the same spot a dozen times rather than fail to secure the particular effect he desires.

Always keep the subject in mind, and whenever

you are riding through the country, or on the tramp across the fields, have an eye out for the beautiful and picturesque, and return with the camera—when the opportunity occurs—to secure the gem for your collection. It would be well to make a note of the points of the view, including the time of day when the view would probably light up at its best. A pocket compass will be found useful in some cases to determine the relative position of the sun at a given hour in the future.

Practice *vs.* Precept.

Better, however, than all the rules and hints that could be given is the discipline that comes from an actual study of nature in her infinite variety of beauty, supplemented by practical work in reproducing her choicest moods in pictures that will last for all time.



CHAPTER VI.

SYNOPSIS OF PROCESS.

IMAGINE, then, that you are equipped with the outfit alluded to—and that you have selected some charming bit of scenery or pleasing effect in architecture of which you wish to secure a picture. You first make a “negative” of one of the “dry plates,” by “exposing” it in the camera to the action of the light thrown upon it through the lens, in the form of a picture or inverted image of the object.

Developing the Negative.

The plate is again covered from the light and brought to the “dark room” (we use the bath-room, as we can get plenty of water and can easily shut out the light), where, by the light of a red lantern, it is taken out of the plate holder and treated to a simple chemical bath, which changes

what was apparently a plain glass plate, covered with a whitish substance, into a beautiful picture.

The Negative.

This picture is reversed, not only in position—the right side of the object photographed being at the left in the picture—but it is black where it should be white, and *vice versa*, down through all the shades and tints. The sky, which was probably the lightest part of the view, is, in the negative, almost black and nearly opaque, while the dense shadows, or the black coat of a person standing in range, are almost perfectly clear glass. The use of this inversion will be seen when you arrive at

Making the Print.

This is done by taking a sheet of sensitive paper, so prepared that wherever the light strikes upon its surface it will turn dark—the shade varying according to the degree of light transmitted. The negative is placed upon this paper, face downwards, and the clear glass, representing the dark parts of the object, admits the light fully, turning the paper black, while the opaque tint of the sky in the negative intercepts the light, and the paper remains white. The fine gradations and half tints

are given by the semi-transparent parts of the negative, each being in a milder degree the reverse of nature.

Toning—Fixing—Mounting.

The print is now “toned,” a process which brings out the color and brilliancy. It is then treated to a fixing bath to render it permanent, and afterwards mounted on card, when it may be presented to the admiring gaze of friends, a finished picture.

In this series of lessons it will be the object to give such plain and simple directions for each of the successive processes that any person, not an absolute idiot, can understand them, and any one with a love of art, and not wholly deficient in patience and ingenuity, can succeed in producing creditable pictures.



CHAPTER VII.

SECURING THE NEGATIVE.



HAVE an impression that the last instalment was a trifle dull and uninteresting, and that the real fun begins with this chapter. After so much preliminary theory and explanation, it is time for a little practical work, and practice is more satisfactory than theory.

Getting Ready.

First we must put the plates into the dark plate holder, so that they may be carried safely, exposed in the camera, and brought back for development.

The plates come from the dealer in a paste-board box, and this box is wrapped in paper and carefully pasted up, so as to prevent the possibility of any light coming to the plates.

Cut off the paper wrapper, but *do not open the box yet*. If any ordinary light strikes the plates, they are spoiled at once.

We know that the white light of the sun is a compound light, composed of three primary colors—red, blue, and yellow,—and that all the tints of the rainbow are the result of a mixture of these colors in a certain order; the hundreds of colors not in the rainbow, such as “sage green,” “crushed strawberry,” etc., being mixtures of the same colors out of that order.

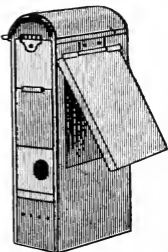
Now the chemical, or “actinic,” effect of light is confined almost exclusively to the blue rays, and in order to destroy this actinic power we have but to strain out the blue light.

This we do by passing the light through a red or orange medium—ruby glass being most frequently used—and for this reason all the operations with dry plates, up to the fixing of the negative, are conducted under a red light.

The Red Lantern.

For this purpose, the dealers in photographic apparatus furnish a lantern which gives only a red light, as a part of the outfit. If the outfit does not include the red lantern, or if you prefer to save

the expense, go to any dealer and get a sheet of translucent ruby paper, fold and gum it in the form of a cylinder or truncated cone, say eighteen inches tall, eight inches in diameter at the bottom and five inches at the top. Place this over any ordinary hand-lamp, and you have a red light which may answer your purpose.



Filling The Plate-Holder.

Now take your box of plates and your red light into some room which can be made perfectly dark, and stop out every bit of light. Perhaps the best scheme is to do this, as well as the developing, in the evening—simply carrying the lamps out of the room or turning out the gas.

Open the box and take out a plate, and you will see that one side is bright and shiny, while the other has a dull look. The dull side is the sensitive film. Do not let the fingers touch the surface. If it is not larger than 5x8, the fingers will easily grasp it by the opposite edges.

Before putting it in the plate-holder the film should be *swept* by a soft brush, to cleanse it from

any dust that may be on it, as every bit of dust will intercept the light during exposure, making a clear spot on your negative and, consequently, a black speck on your print. For this purpose a flat camel's hair brush, one and a half inches wide, which costs thirty cents, will be just the thing.



CAMEL'S HAIR BRUSH.

Put the plate into the holder so that the film side will be outward—next the slide—and close the plate-holder carefully, excluding the admission of light, so that it may be taken out into the light of day.

As everything depends upon keeping the plate in absolute darkness, the necessity of a perfectly tight plate-holder will be obvious. A leaky plate-holder is an awful poor piece of property.

There are so many different forms of plate-holder that it is useless to give any definite directions for putting in the plate, but the matter is simple enough and the amateur will have no difficulty.

CHAPTER VIII.

THE START.

AFTER filling as many holders as you wish, place them in the camera box, and you are ready for the start.

If you are on a long tramp it would be a good plan to take along a lunch, as the walk in the fields and woods gives one a wonderful appetite. A cup for drinking, some matches and a good stout clasp-knife have, upon such occasions, appropriate uses.

If you have a field-glass, a microscope, or a tin box for captured flowers or bugs, and have any idea of their use, take them along. If you have a friend or two of your own sex, or even of the other persuasion, invite them to join you, provided they are congenial company and good walkers. There is a blessed satisfaction in having some one to whom you can turn and say, "It is your turn to carry the box."

When you see some picturesque bit of landscape

or fine building of which you want a picture, stop and set down the box.

Setting up the Camera.

Unfold the legs of the tripod (if it be a folding tripod), spring them into their places in the tripod-head, and set up the tripod.

Screw the camera in place on the top of the tripod.

Take out the lens from the inside of the camera, and screw it into its place in the flange in the front board, and take the cap off the lens.

Focusing.

Now take the focusing cloth and throw it over the back of the camera and your head, so as to shut out the light, and draw the back of the camera, which carries the ground-glass, toward you until you see a beautiful picture of the view in front of the camera formed upon the ground-glass. In some of the newer styles of camera the back is rigid, and the front slides,—the same effect (increasing the distance between the lens and the ground-glass) being produced in either case.

You will find that there is a particular point at which the picture is perfectly sharp and distinct, or,

in other words, is perfectly in focus (see "Focus," page 122). When this point is found, fasten the camera in position by means of the clamping screw at the back or side.

You can swing the camera to take in just the section of the landscape you prefer by loosing the tripod screw—afterwards clamping it in position.

If you have no swing-back, the camera should be perfectly level both ways. This can be easily tested by a string from which a small weight is suspended—making a plumb-line.

One of those spring measuring tapes, that are sold in the street for ten cents, makes a good enough plumb-line, and is a handy thing to have in your pocket for other purposes. If the back of the camera is found to be vertical, the camera is level. The use of the swing-back and rising front is explained on page 36.

If you wish to include a wider view, move the camera back farther from the object. If you wish the object to appear larger, move the camera nearer. If the point of view does not suit you, take up the camera and tripod bodily and carry it to a better point. Take time to get the best result possible.

When everything is satisfactory remove the ground-glass, by turning it down or taking it off, and fasten the plate-holder in its place, being sure that it fits properly.

Use a stop to graduate your light and to get depth of focus (see "Stops," page 124). *Put the cap on the lens.*

If the plate-holder is a double one it should be marked "I" on one side and "II" on the other. See that the "I" is uppermost. It is a good plan to cover the camera with the focusing cloth as an extra precaution against outside light.

The Exposure.

Now comes the climax for which all this preparation has been made; and a good deal of care, judgment and coolness is necessary in the following steps. The plates generally furnished to beginners are of medium rapidity, say Carbutt's "B," which require, in good sunlight, with a single lens and a one quarter inch stop, about fifteen seconds exposure, or with a compound lens, with a three eighths inch stop, perhaps eight seconds. There are more rapid plates which require less than a third of this exposure, and instantaneous plates which receive the impression in a fraction of a second, of which I will tell you later.

Be sure that the cap is on the lens. Withdraw the slide next the lens in the plate-holder and place it upon the top of the camera. Take your watch in your left hand (or, better, learn to count without a

watch), remove the cap with your right hand and count, steadily and calmly, the right number of seconds. Replace the cap, *push in the slide*, and the thing is done.

After you have eaten your lunch, tramp to the scene of your next triumph. If the distance is short you can carry tripod and camera over your shoulder.

On arrival, go through the same operation with plate No. 2, taking particular care not to make both exposures *on the same plate*.

To impress this lesson upon your mind, and to amuse you while digesting your lunch, we will tell you a story in point.

Our First Negative.*

Ever since the grand discovery of Daguerre, under whose tuition Old Sol made his *début* as an artist, I have had an insatiable desire to dabble in photography, but had regarded it as too occult and mysterious a matter for the unprofessional mind to grapple with.

Eighteen months ago, however, I learned, to my surprise and delight, that any person of fair intelligence could, with the modern improvements of

* Originally contributed to the *Photographic Times*.

"dry plates," etc., succeed in making pictures of any bit of landscape or other object that might please the fancy, and I made up my mind to count in.

Paul, the nineteen-year-old, seconded the motion with enthusiasm and unanimity.

In due time the apparatus arrived, and we were as pleased as the traditional kitten with the dual caudal termination. It was of the size to take a 5x8 picture, and the outfit included all the implements, chemicals and other fixings for the complete process, with plates and sensitive paper sufficient for an extended series of experiments.

Of course, we were impatient for the practical fun to commence, and, the first time that Paul could get a day off, I tore myself away from the office and we packed up the traps, prepared, like Moses on Mount Pisgah, to "view" the landscape o'er.

We took the Third avenue and "dummy" line to Fifty-fifth Street (Brooklyn), which leads to the boat-house of the Atlantic Yacht Club, and walked to the sea-shore. It was a lovely day, and the view of the bay was charming. The shore was lined with boats laid up for the winter, old hulks useless and *ausgespielt*, driftwood and nautical traps, and the water, glittering in the sunlight and flecked with snowy sails, reflected the blue of a perfect October sky.

An old boat lay upon the bank in a picturesque pose, and the boy sat down upon its side while I set up the tripod and got him in focus. It was a pretty picture that I saw on the ground-glass, although it was inverted. I put on the cap, put in the plate-holder, and pulled out the slide. It was easy enough to time it. My heart beats seconds, as my normal pulse is just sixty per minute, and I needed no watch. The sitting was made, the cap and slide replaced, and the machine packed for a continuance of the tramp.

Over the brow of the bluff at the foot of Forty-ninth Street was a boat-house with balconies, etc., which formed rather an attractive feature of the landscape, and we determined to carry home a negative of it. There were some trees, a cow, and other rural features, and we placed the open carrying-case in the foreground for added variety. I turned the plate-holder over, as I supposed, so as to expose the other plate, and Paul was the operator; then we packed up and went home.

That evening we mixed our chemicals, according to directions, and proceeded to "develop" the first plate. We soaked it an hour, but it refused to come up in spite of our utmost efforts. As we did not propose to give up, we resolved to try the second plate; but just as we commenced, a visitor called to inquire about amateur photography and I left the

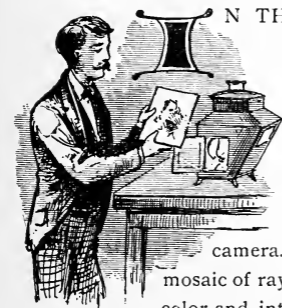
matter in Paul's hands. In a few minutes he sung out "It's coming, Pap!" and a moment later an exclamation of astonishment brought me to his side. The boat and boy had developed first, and then the boat-house on the same plate! It dawned upon us that we had taken both pictures on the *first* plate, and that the plate we had spent so much time over had not been exposed at all. It was an awful humiliation, but we finished up the negative, which was a good one in other respects, and it made the funniest picture you ever saw. A dismantled yacht was sailing up among the apple trees, a rail fence ran down through the middle of the boat-house, and the carrying-case usurped the locality of the boy's digestive apparatus.

We had fondly hoped that our friends would be surprised at our proficiency, and this picture filled the bill! They were more than surprised. After gazing at it for a minute, they regretfully concluded they "had got 'em" at last, and went and signed the temperance pledge.

Since this first lesson, we have made some pictures that were almost perfect.

CHAPTER IX.

DEVELOPING THE NEGATIVE.



IN THE last chapter we exposed the sensitive gelatine film to the impression of the inverted picture which we had seen upon the ground-glass screen at the back of the camera. This image was a mosaic of rays of light, of differing color and intensity, reflected from the various objects in front of the camera, and focused sharply by the lens.

These rays of light produced a chemical effect upon the surface of the film, which, when combined with the action of certain chemical reagents, changes the chloride of silver in the film to a metallic oxide of silver, which is black

in color, and opaque in proportion to its thickness.

The parts of the picture upon which the greatest light has fallen turn black, while those upon which little or no light has been thrown remain nearly white, and become, after "fixing," nearly or quite transparent; and thus the "negative" is produced, as described in Chapter VI.

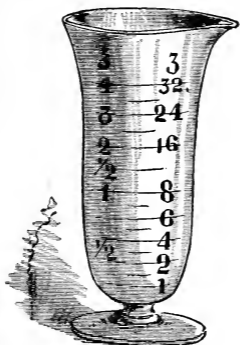
The "development," which brings a beautiful picture out on the plain, milky-white surface of a glass plate is the most delightful and fascinating thing in the whole process. It requires the utmost care, and even with care occasional failures may be expected. I shall rely upon my readers to do their *best* to achieve success, and if they do they cannot altogether fail.

Ferrous-Oxalate Development.

If you have bought a regular outfit, it probably includes all the chemicals and apparatus you will need. If not, you can get them of any druggist or dealer in photographic materials.

To start with, you will want one pound of neutral oxalate of potash, one pound of proto-sulphate of iron (copperas), one pound hypo-sulphite of soda, one ounce bromide of potassium, one ounce sulphuric acid, and two ounces of oxalic acid.

You will also need two glass "graduates" or measures for fluid ounces, drachms, etc., like those



FOUR-OUNCE GRADUATE.

in the cut, one of four ounces, and the other of one ounce capacity, and two oblong japanned pans of the size of your plates. Mark one D for



DEVELOPING PAN.

"developing," and the other H for "hypo." You will also need a small pair of scales for weighing grains.

Before proceeding further, your solutions must be prepared.

Formulas.

FOR SOLUTION NO. 1.*

Put into a quart bottle eight ounces of neutral oxalate of potash, one half drachm of bromide of potassium, one half drachm oxalic acid, and fill up the bottle with warm water. Shake occasionally until dissolved, and label "No. 1."

FOR SOLUTION NO. 2.

Put into a quart bottle one half pound proto-sulphate of iron and thirty drops of sulphuric acid. Fill up with warm water, and label "No. 2."

FOR THE FIXING SOLUTION.

Pu. one pound of hypo-sulphite of soda into a quart bottle, fill up with water, and label it "Hypo."

It is better to mix these solutions at least a day before you use them.

Preparing the Developer.

Bring your bottles of solution, the pans, and graduates and the plate-holder into the dark room, light your red lantern and shut out all other light.

* See table on page 142.

Measure out two ounces of solution No. 1 in the four-ounce graduate ; measure three drachms of solution No. 2 in the small graduate, and pour it into No. 1, when you will observe a curious chemical change, the union of the two nearly colorless fluids producing a ferrous-oxalate solution of a deep orange color.

If the weather is warm, put in two or three lumps of ice of the size of a walnut. *The solution should not be warmer than sixty degrees.*

Fill a tumbler one third full of the hypo, add as much water and a few pieces of ice.

Have a pitcher of ice water handy for washing the plates, etc.

Developing.

Take the plate-holder and pull out the central stopper or slide ; raise the opposite end until the plates slide down into the right hand, which must be held in position to stop them.

Draw out one of the plates, and, holding it by the edges, place it film side up in the pan marked D, and shut the other plate in the holder.

Or, take out the plate, whatever the construction of the holder.

Pour cold water on it, and let it remain for a minute to wet the surface, so that the solution will flow evenly, without streaks or air-bubbles.

Pour out the water, but not the plate, and pour over it at once the contents of the large graduate.

Now, watch it carefully by the light of the red lantern, rocking it gently, so as to flow the solution back and forth, and in a short time—say fifteen seconds—you will see dark streaks appear.

The sky, which is probably the lightest part of the picture, or perhaps a white house, if there is one, will appear first, then the windows and other details, and last of all the darker parts, such as foliage and objects in shadow.

Keep cool and watch the growth of the picture closely, and when the detail is nearly all out in the darkest parts, pour the developer back into the graduate, and pour water into the pan.

If, during development, the picture seems to be growing gray and disappearing, don't be alarmed—develop until you get all the details you want. If the development stops before the details are all out, it is because the exposure was *too short*. If, on the other hand, the picture comes out all at once, and all alike, without contrast or character, it is because of *over-exposure*. To avoid these mistakes, you should always keep a record of length of exposure, the time of day, kind of weather, brand of plates, and other details, so that you may take advantage of your experience to become perfect. For this purpose a book of blanks, like the following, will be found convenient.

AMATEUR'S RECORD BLANK.

HINTS FOR DEVELOPING.

Kind of Plate,.....

Date of Exposure,.....

Condition of Light,.....

Time of Day,.....

Length of Exposure,.....

Kind of Lens,.....

Number of Stop,.....

Subject,.....

REMARKS

It is wonderful what a difference the light makes in the necessary time of exposure. At Coney Island, last summer, where the intense sunlight was reflected from the white sand and the blue water, we spoiled a plate by a too long exposure of *one half a second*. The same plate might have been exposed in a parlor, in taking an interior view, for an hour, and still be spoiled by *under-exposure*. An object, in the full light of a summer sun, will require perhaps one quarter of the time which would be needed in the shadow of trees or on a cloudy day.

If you believe the plate to be over-exposed, start with two drachms of iron instead of three ; then, if the image comes up too slowly, add more iron, *but never more than one part to four of the oxalate*.

The best plan is to time every plate *just right*. For this reason it is a good scheme to start with a small outfit, as you can spoil four 4x5 plates at the same expense as one 8x10. This can be done with the larger instrument, by the use of a reducing "kit" for the plate-holder.

Pyro Development.

We have described the ferrous-oxalate development, because it has been regarded as the most simple and easily managed, and for that reason es-

pecially adapted to the work of amateurs. There is, however, a newer method of development, which has important advantages in several respects, called the "Pyro" development—Pyro, being short for pyrogallic acid.

This developer is more rapid than the other, and can be strengthened to any required degree, for instantaneous or insufficient exposures, without danger of precipitation. It is believed to produce a softer negative than the oxalate with fuller detail, and without material loss of brilliancy.

Chemicals.

The chemicals for Pyro development are:

Pyrogallic acid (Schering's), which is a white powder, very light and dry.

Sulphite of soda, which comes in one pound bottles and must be kept stopped from the air, as it has a great affinity for moisture.

Sal-soda (common washing soda), which may be bought of the grocer, and costs about two cents per pound.

Sulphurous acid, a liquid, somewhat sour and highly volatile, and must be kept stoppered.

Water for this purpose should be as pure as possible. If pure water cannot otherwise be obtained for the solutions, use distilled water.

Formula.

SOLUTION NO. 1.

1 ounce sulphite of soda crystals; $1\frac{1}{2}$ ounces hot water. When cool, add to it $\frac{1}{4}$ ounce pyro; 1 ounce sulphurous acid

SOLUTION NO. 2.

200 grains crystal sulphite soda; 200 grains sal-soda; 20 ounces water.

To Develop.

For a 5×8 plate take 2 drams of No. 1 and pour into 2 ounces of No. 2. For a larger plate use the same proportion—one dram of No. 1 to one ounce of No. 2.

Do not wet the plate, but place it in the bottom of the pan and flow it quickly over. If the exposure was properly timed the result will be perfect. Develop until sufficient detail and intensity are secured, wash under the faucet and fix in the hypo.

If under-exposed (which will be indicated if the image appears very slowly), add soda solution from a separate bottle, kept on hand for the purpose.

For over-exposure (in which case the image flashes out too quickly), use old developer, which

should always be saved for the purpose, or reduce the developer in the pan by adding water.

For instantaneous views use plenty of soda.

If yellow stains occur, or frilling appears, place in a saturated solution of alum for a few minutes.

Intensifying Negatives.

Sometimes a negative is good in other respects, but is too thin, or lacks "intensity." When this occurs, from over-exposure, or under-development or any other cause, the best thing you can do is to go and take another view, using the experience you have gained to help you to secure a better result.

If you use a good make of plates, you never need have a thin negative.

If, however, the negative is too thin to print, and you cannot secure the subject a second time, the negative may be intensified. I give here a formula which is used by Mr. Roche, a photographer of some celebrity, and which is one of the simplest:

ROCHE'S INTENSIFIER.

Water.....	10 ounces.
Sulphate of copper.....	100 grains.
Bromide of potassium	100 "

When dissolved, this solution is ready for application, and can be used repeatedly. The negative,

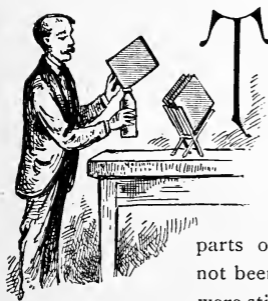
after fixing and washing, is immersed in this solution until it bleaches or turns white.

Now remove and wash slightly, then immerse the plate in the ferrous-oxalate developer, and allow it to remain until it is black entirely through the film. This mode gives fine results and a good printing color.



CHAPTER X.

FIXING AND VARNISHING.



HE plate was left at the close of the last chapter at the stage in which a picture, in varying shades of blackness and opacity, was made visible upon the surface, and the

parts of the film which had not been acted upon by light were still milky-white. Under

the red light they appeared a delicate pink, but they were white, all the same. The application of the hypo solution dissolves this milky substance, and leaves these parts clear and transparent. At the same time the chloride of silver is dissolved out of the film, so that it is no longer sensitive to light, and no further change can occur in it by exposure. For this reason it is called "fixing" the negative.

Fixing.

Take the plate out of the pan in which it lies (first pouring off the water), lay it face upward, in the pan marked H, and pour over it the hypo solution in the tumbler. Watch it carefully, and you will soon see that the milky whiteness is beginning to disappear from the picture.

Let it remain until every particle of white has been removed. This may be best observed by turning the plate up with the fingers, being careful not to touch its face, and looking through the back of the glass.

When the last patch of white disappears the negative is fixed, and it may be taken out into the light without danger. Practically, it can be taken out at any time after the hypo begins to act, and the process of fixing can be watched by the outer light.

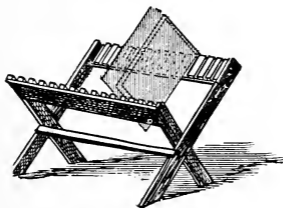
Take it to the kitchen-sink, and if the weather is cool, rinse it thoroughly under the cold-water faucet. If it is summer, pour the hypo back into the tumbler, to be used for the second plate, and fill the pan with ice-water. Let it stand for ten minutes, and replace it with fresh water. After two or three changes the plate will be sufficiently washed.

When you become able to make a negative that is really worth keeping you must wash very thor-

oughly, as the smallest trace of hypo in the film will, in time, destroy the negative.

If you have used ice-water, and your plates are of a good brand, you will have no trouble in making a good negative. If, however, the water is warm, the film will pucker or "frill," especially at the edges, and perhaps come off the glass altogether.

The remedy for this is a bath of strong alum water, which toughens the gelatine, by a process analogous to tanning. The alum water should be



NEGATIVE RACK.

what is called a "saturated" solution—that is, a solution that is as strong as can be made with *warm* water. In preparing and keeping saturated solution of any salt, it is safe to put in enough so that a part remains undissolved at the bottom.

After the plate is well washed, set it up to dry in some place where the face will not come in contact with anything.

The best arrangement is a "negative rack" like

the cut, which may be bought for a small sum, but which I would advise you to make. You will see that the narrow boards upon which the two edges of the plate rest are grooved to hold it in place. It is awful easy to make.

You can now go again to the dark room, take out the other plate, and develop it with the mixed solution before used. Be careful to *never use the hypo pan for developing*, and never get any hypo into anything but the pan marked H. Wash your fingers carefully after fixing a plate.

Put the second plate through the same processes until it is safe in the negative rack.

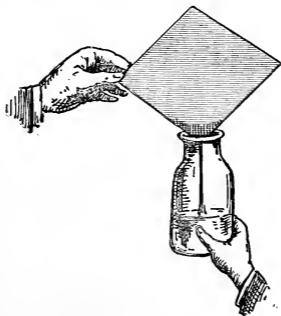
Varnishing the Negative.

Before varnishing, the film must be thoroughly dry. After an hour or so you will see that the edges of the plate are drying and becoming dull in color. This margin will keep growing until the whole plate is dry, and may be varnished. As a measure of safety, however, it is well to let it remain in a warm place for three or four hours, as the surface turns milky and the plate is spoiled if varnished before it is absolutely dry.

As the varnishing is done to protect the surface from wear, merely, and not to improve the plate, it is not necessary to varnish unless the negative is a

particularly good one, and you wish to preserve it, or unless a large number of prints are to be made from it.

“Negative varnish” is a thin, quick-drying varnish sold for the purpose. When ready to apply, take the plate in the left hand, film side up, placing the fingers under the plate and the thumb against the corner, and with the right hand pour a pool of



FLOWING PLATE.

varnish, about three inches across, on the middle of the plate; incline the plate so that it flows first to one corner then to the next, and so round the plate.

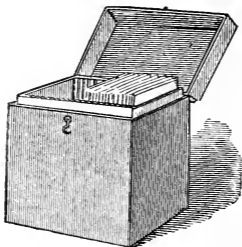
As the last corner is reached hold the mouth of the bottle under and pour off the surplus varnish, rocking the plate slowly to prevent streaks.

Dry in a warm place, out of any draught, as a chill while drying makes the varnish granular and

opaque. When thoroughly dry, which takes but a few minutes, it is ready to be printed from.

The negatives should be kept where they will not be rubbed, and the best arrangement for the purpose is a negative box like the cut, made with vertical grooves to hold the plates safely apart. It may be bought from the dealers, or you can exercise your ingenuity in its construction.

When you have acquired a good stock of nega-

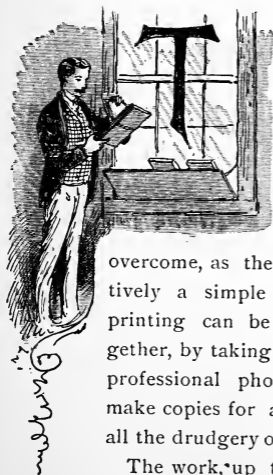


NEGATIVE BOX.

tives, or, rather, a stock of *good* negatives, you have a valuable possession. You can always sell prints from a good negative, or you can even sell the negative itself. A friend of mine has a set of instantaneous views which are very fine indeed, and he was offered ten dollars each for the negatives for printing magic-lantern slides. He refused, and has since sold at least two hundred dollars' worth of pictures from them.

CHAPTER XI.

PRINTING.



THE last lesson carried us to the point where we had finished a negative ready for printing.

If this is accomplished satisfactorily the only formidable difficulties have been

overcome, as the printing is comparatively a simple matter. In fact the printing can be dispensed with altogether, by taking the negative to some professional photographer, who will make copies for a small sum, and save all the drudgery of this part of the work.

The work, up to this point, has embodied the individual taste and skill of the operator, but the mere reproduction of copies of this result could be entrusted to others.

We propose, however, to give full and explicit instructions in printing, and will devote this chapter to the simplest and easiest process, known as *ferro-prussiate*, or "blue" printing.

Making "Blue Prints."

For this purpose you will need a printing-frame, like the cut, which may be bought of any photographic supply store, and some sheets of "blue" photographic paper. You can buy this cut to the size of your negative, by the dozen, or you can buy the paper by the yard and cut it yourself in a dim light.

Printing.

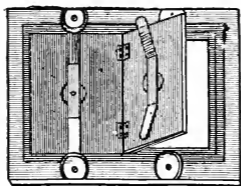
Take out the back of the frame, by pressing upon the ends of the springs and swinging them to one side.

Place the negative in the frame, with the gelatine side up, and lay one of the sheets of paper, face downward, upon it. Now replace the hinged back of the frame, and fasten it in position by means of the springs.

Place the frame in the sun, in such a position that the light will strike the glass squarely, and let it remain for, say, ten minutes.

Take in the frame and open one end of the hinged back (being careful not to expose the paper to direct sunlight), and examine the print. If the greenish gray of the paper is changed in places to a sort of blue, and the outline is positive and decided, it is sufficiently printed; if not, clamp down the back and place again in the sun.

When it is in your judgment sufficiently exposed,



PRINTING-FRAME.

open the frame, take out the paper and carry it to the kitchen sink, or some place where you can get plenty of water, and wash the paper until the water is no longer tinged with yellowish green. When well washed hang the print in the sun until dry, and you will have a beautiful picture in blue and white. The contrasts are not quite so sharp and strong as in the black and white tints of a well-toned silver print, but the picture is a very pleasing one, and the process is extremely easy.

If, when dry, you find the picture too dark, it in-

icates that it has remained too long in the sun. If, on the other hand, the picture is pale, and the outlines imperfect, the printing has been insufficient. After a few trials you will learn to time it by the clock, without opening the frame during printing.

Mounting.

Your picture will not look finished until it is mounted on card, of a proper size and color. For a blue print a white card is as pleasing as any, but black, chocolate, or some other color may be preferred. If a white card is used, it should be cut so as to give a margin equal to about one fourth the width of the print. Cards for the different sizes of prints may be bought already cut, and having printed upon them a border-line of gilt, which adds to the attractiveness as well as the apparent size of the picture.

Trimming.

The best way to trim a print is to lay it on a flat pane of glass, and with a ruler or straight-edge and a sharp knife, cut to the required size. The glass makes a good surface to cut against, and the knife does not become dull, as might be expected.

For regular sizes a bevelled glass form of the

required dimensions is convenient, as it saves measuring, gives rectangular corners, and, being transparent, allows the picture to be seen, and the best part selected.

Pasting.

Wet the print to take out the curl and to make it pliable, and lay it face downward on a pane of glass, pressing out the superfluous water with the hand, or absorbing it with blotting-paper.

With a one-inch flat paste brush cover the back of the print evenly with a stiff solution of starch, precisely like that which is used in laundry work. Take the print up by the corners, turn it over and place it in position on the centre of the card, then cover with a cloth or paper and rub with the hand until all wrinkles or bubbles are removed, and the print lies perfectly smooth.

In drying the prints it is a good plan to place them between sheets of blotting paper, and press between flat surfaces until quite dry, after which they will remain nearly or quite flat.

CHAPTER XII.

MAKING SILVER PRINTS.

To become a good printer a great deal of care and taste are necessary, but with these and other conditions favorable it is the easiest and pleasantest part of the work. As I before said, if good pictures are wanted, and the practice is not desired, the prints will be made by any professional photographer for a very reasonable price. I hope, however, that my readers will insist on making the whole picture, and I shall endeavor to show them the simplest and most perfect method of doing it. The sensitizing of the paper, like the preparation of the plates, can be safely confided to the manufacturers, and it can be bought ready for use in any desired quantity.

The ready sensitized albumen paper comes in sheets of 18x22 inches. Take it into a dim light, such as a dark corner of your room, and cut it into pieces of the size of your negative.

Fumigating.

You will shorten the time of printing, and get finer effects of tone, if you fumigate the paper with ammonia vapor. For this purpose a box should be fitted up to hold the sheets in such a manner that the face of each will be exposed to the vapor from a saucer of ammonia set in the bottom of the box. A door should be adjusted to shut tightly, and the paper should be left in for ten minutes.

Printing.

Place the negative in the frame as before, film side up; lay the paper, albumen side down, upon it, and fasten the back in place by the springs, so as to ensure a close contact of the faces of the paper and negative, as is absolutely necessary in order to secure a sharp print. For this purpose the back should be padded on the inside, to insure a uniform pressure on all parts of the surface.

Set it out in the sun or in a bright light, and examine it occasionally to observe the progress of the printing. The length of time will depend upon the light, and the relative density of the negative. Print until the picture is much darker than the finished print is to be, as the toning process reduces

the color. If the negative is thin and transparent, it should not be placed in direct sunlight, and the thinner portions may even need to be covered with tissue paper, at a little distance from the glass. To make a good picture from a poor negative requires judgment and practice, and in fact you may study this branch for years and still find something to learn.

Toning.

A sufficient number of prints having been made, the next process in order is the "toning."

The object of toning is to clear up the picture, making the whites white, and the blacks of the particular dark shade that pleases the artist. Some prefer a dense black for the deepest shadows, while others are fond of a warm reddish brown, or a bluish tint.

The solutions for toning are prepared as follows:

SOLUTION 1.

Water, 20 ounces; common salt, a pinch.

SOLUTION 2.

Chloride of gold, 6 grains; water, 6 ounces.

SOLUTION 3.

Bicarbonate of soda, 1 ounce; water, 4 ounces.

For toning, you will need two or three oblong pans, somewhat larger than your prints, of japanned, "granite" or porcelain ware. The japanned pans are cheap, and will answer a good purpose, but will not wear as long as the higher priced pans.

First wash out the silver salts by immersing the prints in a pan full of water, being careful that they do not stick together, and handling them over to give the water access to every part of them. The best method of doing this is pull out gently the bottom print and place it on the top, and continue to do this as long as they are in the bath. Wash in several changes of water, or until the water is free from milky sediment.

Mixing the Toning Bath.

Place in a quart jar the whole of solution No. 1, with one fluid ounce of No. 2, and sufficient of No. 3 to cause red litmus paper to turn purple.

Let it stand fifteen minutes before using. It will keep a long time, and may be used more than once.

While the toning bath is standing, soak the washed prints in a solution made of water, 20 ounces; acetic acid, $\frac{1}{2}$ ounce.

The prints will change from a purple black to a

reddish brown. When this color is quite deep, they are ready to tone. This *acidifying* is done to enable the artist to observe the changes of color, which indicate the progress of the toning, which gradually brings back something like the original color.

The Toning Bath.

Pour the toning bath from the jar to one of the pans, and immerse the prints. Turn them frequently and watch the color carefully, and when the color has changed to a dark bluish tint, place in fresh water and wash thoroughly.

It is difficult to give precise directions as to the point at which to stop, as the taste of the artist may demand a cold or warmer tint, and the prints from some negatives require more toning than others. It is believed that a thoroughly toned picture is more permanent than one under-printed and under-toned.

• Fixing.

The purpose of "fixing" is to neutralize the chemicals that are alterable by light, and make the picture permanent.

The Fixing Bath.

This is made of hyposulphite of soda and water, in the following proportions:

Water, 10 ounces; hypo, 1 ounce.

(It is better to dissolve one or two quarts at once, as the hypo is cheap, and it saves trouble.)

When thoroughly dissolved, pour into the hypo pan, and soak the toned prints for fifteen or twenty minutes, keeping them in motion by frequent turning. Then wash *very thoroughly* in pure water with frequent changes. If in running water, it will require about two hours, or a quarter of that time, if held under a tap.

Mounting.

The process of mounting is the same as already described for blue prints. If many prints are to be mounted, they may be placed in a pile upon a pane of glass, face downwards, and the paste brushed over the backs, taking care that the edges and corners are thoroughly covered. Take up the top print by inserting a penknife blade under the edge, and mount it on the card as before directed. Then apply the paste to the next, and so on.

Spotting.

Any white specks may be touched out with India ink or a lead pencil.

Burnishing.

The burnishing which gives a fine gloss, and brings out the picture, is done by passing the mounted print, when dry, between an iron roller and a heated surface of polished steel; as the machine is somewhat expensive, it is better to dispense with it, or carry the work to a professional photographer, who will burnish then for a small consideration.

Printing Clouds.

In a landscape view the effect is heightened by the contrast of cloud forms and tints with the lines of the picture. When there are no clouds in the sky at the time of exposure they can be supplied by the art of the printer.

For this purpose a cloud negative should be prepared by taking a picture of the sky on some day when there happen to be fine clouds. As the clouds are usually in motion, a rapid plate and short

exposure are necessary. Develop rather thin, as you lose detail by too much intensity.

Masking.

To print in your clouds, it is necessary to first "mask" or cover up the sky and print the landscape, and afterwards to mask the landscape and print the sky. To do this a print is first made, and the dividing line between the sky and the tops of buildings, etc., is cut through the paper with a knife or scissors. Now place both of the pieces, thus separated, in the sun, until they are black and opaque.

Place the sky mask on the face of the negative in the printing frame in such a way as to just cover the sky, and place over it the sheet of sensitized paper for your print; when sufficiently printed, take it and the negative out of the frame and put the cloud negative in its place. Now apply the other mask to cover the landscape, replace the picture accurately in position, print in the sky, and your picture is finished. With a little care you will be sure to succeed.

CHAPTER XIII.

PORTRAITS.

THE amateur photographer will do well to disclaim the ability to make portraits. It is a special branch of art, and requires larger and more expressive lenses than those used in landscape work, as well as a skylight, backgrounds and other accessories. It also demands special skill in such work as re-touching.

Something can be done, however, and much fun achieved, provided you do not expect to rival the work of the professional, and are reconciled to the limitations which are unavoidable.

Out-door Groups.

Out-door groups are the easiest and most satisfactory portrait work you can attempt. Pose your subjects in easy, natural, and, if possible, picturesque attitudes, and select the surroundings which

will give the best background. A group seated on the front or back stoop of the house has the double merit of giving a picture of the house and of its inmates. A seat upon an old stone wall in the country, or on a rustic seat in the park, or under the trees at a rural picnic—any of these will be admirable.

See that the different sitters are at nearly the same distance from the camera, as the short range necessary to give the desired size detracts from the depth of focus. Look out that the light illuminates each face, but avoid the direct sunlight, as it gives too strong contrasts and makes the sitters "squint."

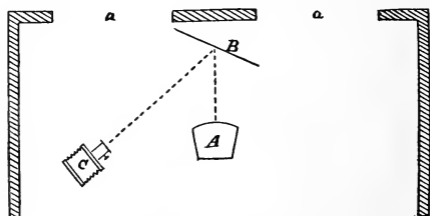
When all is ready, give the command to "keep still!" and make the exposure.

In-door Portraits.

When the windows of a room are large, and the walls and ceilings of a light color, portraits may be made in-doors. Place the sitter facing the light, and, if necessary, reflect light upon the sides of the face by means of some large white surface held at the proper angle. When the lighting suits you make the exposure, giving much more time than out-of-doors; or use rapid plates and a full aperture. Develop for softness rather than boldness of effect.

Mirror Portraits.

The difficulty of getting the camera in position to take the portrait of a person who sits facing the front windows of the parlor or dining-room, is the great obstacle to in-door portraiture. To remedy this a mirror may be used to advantage. We will



SINGLE MIRROR PORTRAIT.

illustrate by a diagram, in which A is the chair of the sitter, whose face is lighted by the windows *a a*. B is a mirror placed upon a table or other support, and C is the camera—the dotted lines showing the course taken by the lines of light from the sitter to the lens. By this means a good illumination and short exposure are possible. Another trick of the mirror is to place it in such a position that both a full face and profile view can be shown

in the same picture. By placing the sitter at A and the mirror at B, the camera at C will take a profile



DOUBLE MIRROR PORTRAIT.

of the sitter at A and a full face of his reflection in the mirror, B.

Vignetting.

The portraits in which the head stands out alone, divested of its surroundings, is called, as you probably know, a "vignette." This effect is produced by covering the face of the printing frame with an opaque paper or card, in the centre of which is a hole of about the contour of the head and bust, but somewhat larger. Place it on the outside of the frame, at a little distance from the glass, and print in diffused light. It will be found that the parts opposite the opening are printed as usual, while the parts in the shadow of the paper are acted upon less and less as the shadow deepens, giving a fine shading to the background.

The same process can be applied to a landscape,

with fine effect, shading off the edges of the picture or suppressing objects which are objectionable.

For instance, if you have a fine house in a block and your next neighbors have shabby ones, you can vignette them out of sight, and the *distingué* effect of your elegant brown-stone will not be marred by their unwelcome intrusion.

The greater the distance of the mask from the negative the more gradual will be the shading into whiteness. A vignette may be printed in direct sunlight by pasting a thickness of tissue paper over the mask.

Medallion Printing.

This is a style adapted to both portraits and landscapes, in which the picture is in an oval, round, or other pleasing form, surrounded by a mat or background of such a tint as contrasts effectively with it.

This is done by cutting from a piece of opaque paper, of the size of the negative, an oval of such proportions as to give an equal margin on all sides, being careful to cut smoothly, and to have the outside as well as the inside of the oval perfect. (See Ovals," page 108.)

Place the outside oval on the negative and, laying the sensitized paper over it, print as usual. On

taking it out it will be found that the picture has a sharp oval outline, leaving the margin white.

Paste the inner oval on the centre of a plain glass (a spoiled negative which has been cleaned) and put it in the place of the negative. Place the print upon the glass so that the oval will just cover the printed portion from the light; print perhaps one quarter as long as the picture was printed, and the mat is produced. The shade may be varied to suit the taste, from a pure white to a dense black.

If the outlines of the ovals do not exactly coincide, a dark line will be printed on one side and a sharp white line will be left on the opposite—an effect which frequently adds much to the artistic finish of the picture.

This is one of the few instances, in this art, in which an improvement can be traced to careless work.

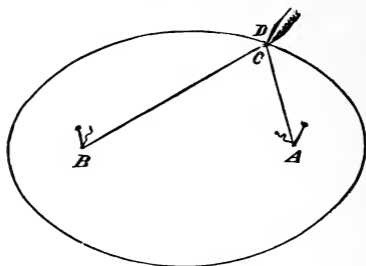
To Draw an Oval.

In cutting out masks for medallion printing, a circle, square, or parallelogram is easy enough for any one who knows the use of a pair of dividers or a T square. A handsome oval is not so easy, unless you happen to know how.

The proper way to draw an oval is to take a string of the length which you wish your oval to

be, and tie the ends to two pins (A, B), which are driven through your paper into a board upon which it lies. The nearer your pins are placed together, the slacker the string will be, and the rounder and fuller will be the resulting oval.

Now draw the string tight by the point of the



DRAWING AN OVAL.

pencil, D, moving the pencil in such a figure as the limits of the string will allow, and the result will be a perfect oval of just the length of the string between the pins. If too round, move the pins further apart. If too long, move them nearer together.

Re-touching.

Any imperfection of the picture may be corrected, or the effect be improved by bringing up the high

lights, through the process of "re-touching." This is done by adding opaque touches with a lead pencil upon the varnished negative, the result being a light or white spot wherever the pencil touches.

For this process the negative is placed upon an inclined ground glass, at a window, in such a manner that the light shines up through it and the outlines are plainly seen. Use the best judgment you have in giving the effect you wish, and it is possible the negative will be improved by your work. It is not, by any means, probable.



CHAPTER XIV.

INTERIORS OF HOUSES.

ONE of the most important innovations which have been made possible by the advent of the rapid dry plate, is the photographing of interiors of parlors, galleries, and even of dimly-lighted churches. For this purpose a wide angle lens is desirable, as the range is necessarily short, and these lenses reach out to each side, including an angle of quite 90 degrees. As the objects are so near, and the relative variation of distance is so great, a small stop should be used to give depth of focus. (See depth of focus, page 123.)

Arrange the furniture for the best effect, and place the camera, if possible, back to the light and a little to one side. The exposure will vary from 15 seconds to two or more hours, according to illumination. To one whose experience has been confined to pictures in bright sunlight, with, perhaps,

instantaneous exposures, it will seem strange to focus the picture, pull out the slide, take off the cap, and then go out to lunch, or "to see a man," locking the door behind you, and returning after an hour or two to finish the job.

If there are very dark corners they may be lit up by throwing sunlight from a mirror held outside, being careful to keep the light moving. A mirror may also be useful in focusing, by throwing sunlight upon a light-colored object placed in the centre of the room, at an "average" distance from the camera. (See focusing with clear glass, page 128.)

If there are windows in direct range of the camera, they should be covered by a black cloth during the exposure, and after capping the lens unveil the window and expose for a few seconds, then re-cap and the windows will be taken without spoiling the rest of the picture.



CHAPTER XV.

PHOTOGRAPHIC TRANSPARENCIES.

THESE elegant pictures for hanging in the window, and for the slides of magic-lanterns, are very easily made. They are called Gelatine "Positives," as the light and shade are not reversed as in the negative, but are the same as in nature.

To make these beautiful decorations, place the negative in the frame as for ordinary printing, then take the frame into the dark room, and by the red light place a dry plate upon it face downward, and fasten down the backboard.

Cover the front of the frame with the focusing cloth, and hold it with the face about two feet from a gas jet or oil lamp. When all ready, remove the cloth for five to twelve seconds, according to the rapidity of the plate, and cover again with the cloth. Carry back to the dark room, and develop with the oxalate developer, fixing and washing as with the negative.

In mounting transparencies, a plate of ground glass of the same size should be placed at the back, and the whole bound at the edges, and provided with rings or loops for hanging up. A little ingenuity will devise some method of framing without cost, or nicely plated frames with rings can be bought of the supply stores.

The positives for lantern slides should be made rather thin, as too great intensity injures them.

The effect of a transparency is much improved by a margin of white. If a margin is desired, use a plate an inch or more wider on all sides than the negative, masking out any irregularities of the edges by an opaque card or paper of the size of the larger plate in which is cut an opening of the size of your picture.



CHAPTER XVI.

INSTANTANEOUS PICTURES.

ONE of the most striking of the recent developments in photographic discovery is the process of taking pictures of objects in motion. The series of photographs by Muybridge, which delineate accurately the motions of a horse or greyhound running or trotting, have achieved a world-wide reputation, and the beautiful marine views of yachts under full sail, and steamboats which throw the spray from their bows and the foam from their paddle-wheels, have elicited the delighted admiration of every lover of art. There is a real and actual *life* in the sparkle of the waves and the light puffs of white steam, that no photograph had ever shown before, and these instantaneous *seascapes* are just now the most popular pictures made.

To produce them requires extremely sensitive plates and a powerful lens furnished with a "drop shutter." The best form of shutter is provided with

a pneumatic arrangement by which the pressure of a rubber bulb at the end of a flexible tube moves a trigger, and a slide drops past the aperture of the lens, making an opening for, perhaps, the twentieth of a second. When a still shorter time is desired, a rubber spring snaps the slide so quickly that the light has only the fiftieth of a second in which to glance through the lens. The spokes of a locomotive wheel going at thirty miles an hour are transfixed, and, instead of the radiating blur which our eyes see, each spoke is distinct and perfect, as if standing still.

The simplest form of drop shutter is that represented in the cut. A thin box of wood has cut through its sides a round aperture to fit the lens tube. A slide of thin wood has a vertical motion in the box, which it fits easily, and in this slide is a hole which, as it falls, passes the holes in the box, and admits the light for a fraction of a second. For slow "instantaneous" exposures, gravity is sufficient, but for very rapid shots a rubber band is attached to accelerate the descent.

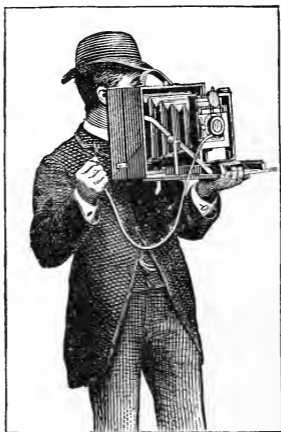
A trigger, operated by the finger, or pneumatically by a rubber bulb and tube, completes the outfit.

In taking these pictures no tripod is needed, and



DROP
SHUTTER.

the camera can be held on the arm in a convenient position to *aim* at the passing boat or other moving object. One ingenious manufacturer has placed a sort of rifle-sight upon the top of the instrument to insure accuracy. When your game comes in



INSTANTANEOUS SHOT.

sight, focus the camera by a pencil mark on the bed, set the drop-shutter and pull out the slide. At the moment when it is in range press the bulb and, *presto!* the swelling sails, the fluttering pennant and the parted waves, crested with foam and flashing with sunlight, are transferred to the sensitive film.

The development of instantaneous negatives must be done with strong and rapid pyro developer, and at the best they are usually somewhat lacking in detail.

The utmost judgment and coolness are demanded at every step of the work, but the result justifies the effort.



CHAPTER XVII.

STEREOSCOPIC PICTURES.

THESE views, which were once so popular, are made by a camera having two lenses, placed as far apart as a person's eyes. The two pictures are cut apart, trimmed into shape and transposed in mounting—that is, the right is placed at the left, and vice versa.

The pictures are then viewed through a stereoscope, the effect of which is to bring the magnified image of one picture over that of the other, giving an effect of perspective and relief, as in nature.

The work necessitates the purchase of a special outfit, and the exercise of unusual skill and care, somewhat out of the range of amateur art. As the pictures are out of fashion—the graphoscope and the 5x8 view having taken their place, I will not go into the details of the work, and I would advise my readers to take the same course.

Photo-Micography.

It is usual in instruction books of this class to insert a prosy chapter on the photographing of microscopic subjects, in order to advertise a special apparatus. The subject is of interest to scientists, but has no more to do with Amateur Photography, popularly speaking, than has the beautiful experiment of photographing the moon.

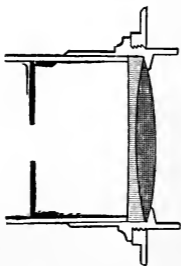
I have tried—with some degree of success, I hope,—to confine this book to the story, and the whole story, of Amateur Photography.



CHAPTER XVIII.

LENSES.

THE ordinary landscape lens is known as a “single acromatic.” The term “acromatic” refers to the method by which the light transmitted is deprived of the prismatic colors seen in a common



SINGLE ACROMATIC LENS.

magnifying glass. This is accomplished by making the lens of two pieces of glass, as seen in the cut which is here given, one being of “crown” and the other of “flint” glass, each of which has a

different refracting power. One side of this combination is rounding, or convex, and the other either flat or concave. In front of the lens the tube is stopped by a partition called a "diaphragm," or "stop," having a circular opening through which the light is admitted.

Rectilinear Lenses.

This arrangement is a very good one for landscape work, where the lines are free and careless, but for architectural work it would not answer, as the effect of the stop, at one side of the lens, is to curve the vertical lines. If in front, they will be

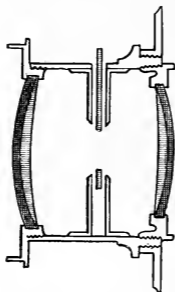


LINEAR DISTORTION.

curved like the staves of a barrel—if behind the lens, they will take the form of a mortar, as in the (exaggerated) examples given in the cut.

To correct this, a double combination has been

contrived, in which two lenses are used, having the diaphragm between them, like the arrangement



RECTILINEAR LENS.

shown in the cut. The double combination is but little, if any, better than the single for common landscapes, but is more rapid, and absolutely rectilinear.

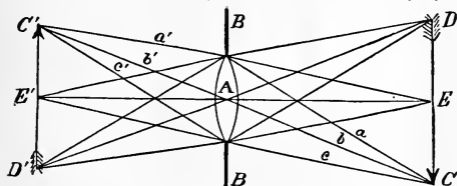
The "Focus."

A plate "in focus" is at the distance from the lens which gives the sharpest image. I will try to explain why.

As I said before, a lens of the usual form refracts the rays of light that pass through it so that they converge to a point, corresponding to a point outside from which they radiated—and this point is called the "focus."

In our illustration, A is a double-convex lens, set

in an aperture in the screen B B. The rays of light a, b, c , from the point of the arrow, passing through the lens A, are refracted, taking the direction a', b', c' , and uniting at the point C'. All the rays from



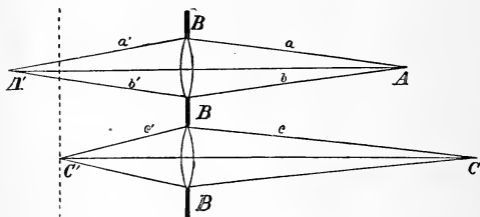
this one point which enter the aperture in the screen join at this second point, forming a *single point of light*, and therefore the image at that point is sharp and distinct—and nowhere else.

"Depth of Focus."

Distant objects focus at a shorter distance than near ones, because the lines of light from them are more nearly parallel, and the same *bend* or refraction brings them together nearer the back of the lens.

Suppose that the ray a , from the point A, is refracted by the lens, taking the direction a' , and meeting the ray b, b' , at A'. If we remove the radiating point to C, and the refraction bends the ray c, c' with the same angle as the ray a, a' is bent,

it will find its focus at C' —a point much nearer the lens than A' . If an object at A and one at C were in the same view, and the screen was so adjusted that one of them was sharp, the other would be indistinct. If the screen was in the position of the dotted line, the object C would be sharply focused at C' , while the image of A would be confused, be-



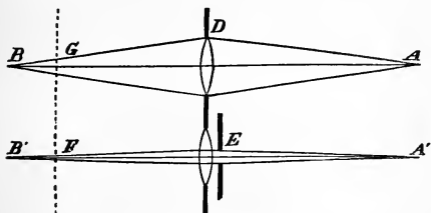
cause the rays (a' b') are so far apart at the point at which the screen intercepts them that they lap over among the rays from other outside points. The lens that produced this effect in a marked degree would be said to be lacking in "depth of focus," or unable to harmonize the images from different depths in the landscape.

Stops—A Partial Remedy.

While some lenses are constructed to obviate this defect in some degree, the best remedy for general use is the diaphragm or stop, which has the effect

of making the lines of light more nearly parallel, so that a variation of the plane of the screen makes less confusion in the image.

For instance, the lines converging from the full



width of the lens *D* meet at the focus *B* in a somewhat obtuse angle. By placing the stop *E* in front of the lens, the lines which meet at *B'* are nearly parallel. If a screen be interposed at the dotted line, the point at *F* will be almost sharp, while that at *G* will be badly out—for the reason before stated.

Averaging the Focus.

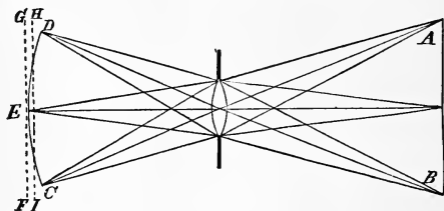
Another use of the stop is in neutralizing the difficulty that arises from the fact that the screen and plate are flat, while the actual plane of sharpest focus is curved.

The inverted image of the arrow *A, B*, is formed

in the air in a curved plane, D, E, C, of which the rays of light are a sort of radii. As the screen is flat it follows that some points of the image are out of focus. This is why the margin of a 5x8 view, made with a cheap lens, is sometimes indistinct.

The remedy for this is to "average" the focus as nearly as possible and use a stop to reduce the trouble to a minimum.

The image of the object A B will be formed in a



curved plane like C E D.* If the screen or ground glass were interposed at the line G F, the image would be sharp at E, but blurred at the margins. By moving the ground glass to H I an average is struck, and the best practical result obtained.

Rule for Averaging Focus.—Measure, with the eye, *one third* the distance from the margin to the centre

* The effects in all these diagrams are much exaggerated, in order to illustrate each point forcibly, and consequently will bear discounting.

and focus sharp at these points, when the best average will be attained.

For instantaneous work, and indeed for most landscapes, the instrument may be focused without using the ground glass at all. Where you have the leisure, focus carefully for different distances, from 10 to 1000 feet, and mark the point at which the back stops on the bed, making a scale which you can read, and you can instantly focus from a mental calculation of the distance.

If your lens has changeable stops always use the full aperture in focusing, as it gives you plenty of light, then put in the stop, to give your picture sharp definition. (See Changeable Stop, page 133.)

If the sun shines brightly, and your subject is of a bright color, reflecting a good deal of light, use a small stop. If cloudy, or if the object is dark and you are inclined to distrust the illumination, use a larger stop.

If you are photographing a building, or other object having fine details of ornament, etc., that you wish to bring out sharply, choose a good bright day and the smallest stop.

Remember that the time of exposure must be increased as the aperture decreases, in proportion to the squares of the diameters. A quarter-inch stop should take *four times* as long an exposure as a half-inch.

The stops of the best lenses are usually so graded that each reduction demands a doubling of the time of exposure.

Focusing with Clear Glass.

Where a specially fine focus is needed, or where the view gives insufficient light to form an image on the ground glass, as in interior views, an un-ground glass can be used to advantage. For this purpose a magnifying lens, with legs, or a tube, to determine its focal distance, must be used.

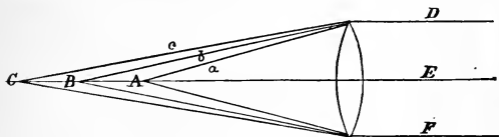
Draw the cloth over the back of the camera and your head, draw the (un)-ground glass nearly into focus, and set the feet of the magnifier against the glass. When the image is seen to be sharp and distinct the camera is in focus. The image is not intercepted by the glass, but is seen inverted in the air.

A good plan is to cover a plain glass with a thin solution of starch, giving an effect much like ground glass, and then scrape from it two diagonal bands of half an inch in width. The semi-opaque portion will give the general position of your view, and the transparent bands the microscopic focus.

Chemical Focus.

The points at which the actinic or chemical rays meet, are in a different plane from those of the color

rays. In the diagram, the rays from the sun, represented by D, E, F, are separated by the lens into heat, light and actinic rays, each being refracted to a different point. The chemical rays are refracted the most and meet at A, the rays of light or color



meeting at B, and the heat rays at C. To compensate for this difference the plate must be held in a plane a little forward of that of the ground-glass, or a lens must be used which is corrected for this sort of aberration.



CHAPTER XIX.

HOME-MADE APPARATUS.

WHILE the greater number of our readers will prefer to purchase their apparatus ready made, there are some who have a special talent for the use of tools, and who will prefer to construct the simpler appliances for themselves, and to save the expense of buying. To such we will give a few hints that may be of value.

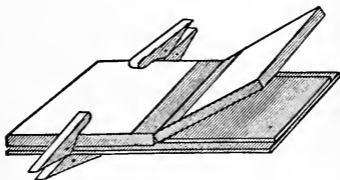
Printing-Frames.

To construct a simple frame for printing, cut a pane of glass one inch wider than the negative you wish to print from. For a 5x8 make the glass 6x8 inches.

Make two pieces of wood 4x6 inches, $\frac{1}{4}$ of an inch thick. Lay them side by side and paste upon the back a strip of stout cotton drilling, say 3 inches wide, so that one half lies each side of the line of juncture. Let it dry, and you have a hinge which holds the halves together.

To complete the device, buy four spring clothes pins, which cost by the dozen about $1\frac{1}{2}$ or 2 cents each.

To use it, lay the 6x8 glass down first, and on this place the 5x8 negative, face upwards. Place the sensitized paper upon the negative, face downwards, padding it at the back with one or more



HOME-MADE PRINTING-FRAME.

thicknesses of woollen cloth. Place your hinged backboard on last, and clamp at the sides with the four clothes pins.

The half-inch at each margin allows the pins to be used without shading the picture, and the hinge permits the work to be inspected as with the more costly printing-frame.

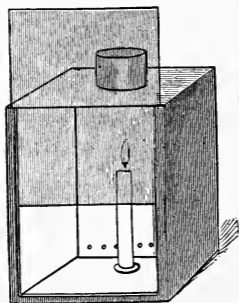
A pair of small brass hinges may be advantageously substituted for the cloth.

Red Lantern.

A box with a slide cover makes a good basis for

an inexpensive or impromptu red lantern. A six-pound starch box will answer admirably.

Remove the slide and replace it with a pane of ruby (copper-flashed) glass. Make a round hole in the top for the escape of the hot current and cover this hole with a round tin box, bottom up, having perforations in the sides. Also, make



HOME-MADE RED LANTERN.

some small holes in the back side of the wooden box, near the bottom, to admit air for combustion.

Now pull up the slide and place a lighted candle inside; shut it, and your red lantern is complete.

If the glass cannot be obtained, two thicknesses of red and one of orange tissue paper will do instead.

Admirable lanterns, giving a powerful light,

shading the eyes, and having many useful features, are in the market at a reasonable price, and no amateur who has much developing work can afford to do without one of the best.

Changeable Stops.

I have elsewhere given the rule, "always focus with the full aperture, putting in the proper stop before making the exposure," or words to that effect. As the cheaper lenses have the stop placed in the tube as a permanent fixture, compliance with the rule seems difficult. It is not, however, impossible.

Take out the lens by unscrewing the annular follower, and you will find, probably, that the stop can be pushed out of the tube.

Fig. 1. is a sectional view of the detached stop.



FIG. 1.

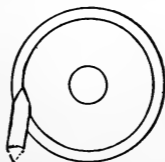


FIG. 2.

Take it to some wood-turner—unless you happen to have a lathe of your own—and turn the end of a

cylinder of wood so that it will just drive on, leaving access for the centre-point of the lathe through the aperture (Fig. 1). With a V-pointed tool cut through the face of the stop $\frac{1}{8}$ of an inch from the circumference (Fig. 2). Now, with a pair of dividers, cut out a circle of thick cardboard, of a size to

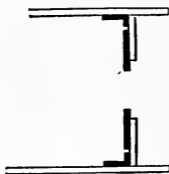


FIG. 3.

fit closely in the lens tube, and from the centre cut a circular aperture a trifle larger than the hole in your stop. Glue this and the inner circle of brass together concentrically and you have a stop that can be changed at pleasure. Blacken the parts to prevent reflection of light. Replace the old stop in the tube, and you will find it gives plenty of light for focusing, after which the new combination can be used for sharp definition. (Fig. 3).

CHAPTER XX.

FAILURES.

“*Fogging*” is the name given to a blurred appearance of the whole plate. Its causes are:

Over-exposure.

Leaking (light) of the camera, plate-holder, or dark room. To ascertain whether the camera leaks, take it out in bright sunlight, draw it out to the full length of the bellows, put on the cap, cover closely with the focusing cloth, and examine the interior carefully with the different sides exposed to the sun.

In ferrous-oxalate development, the use of oxalate which gives alkaline tests with litmus paper. To correct this, add oxalic acid until the solution turns the litmus paper red. (See litmus paper, page 139.)

Too much ammonia in pyro development (yellow fog).—This may be bleached out by soaking in

a saturated solution of alum, and washing before fixing in hypo.

The presence of minute quantities of hypo in the developing solution.

Stained films are caused by insufficient washing of the plate after developing and before fixing, or by exposure to light and air after fixing and before washing.

Frilling is a swelling and puckering of the edges of the film, caused by development in solutions of too high a temperature, and occurring in warm weather. The remedy is a bath of a saturated solution of alum.

Crystallization on the surface of the negative shows that the salts were not thoroughly washed out of the negative.

Pin-holes in the negative show that grains of dust were on the plate, shielding it from the light during exposure, or that an air bubble, during development, prevented contact of the solution with the plate, or that the developer was too strong.

Fading of the negative indicates that the hypo was not washed out properly, and is destroying the film.

Precipitation of a yellow granular deposit upon the plate, in the ferrous oxalate development, is caused by too much iron or too weak a solution of oxalate. Both solutions should be saturated. One part to four of the oxalate is the limit.

Opaqueness of the varnish occurs when the plate is chilled while drying. Always dry in a warm place.

The remedy is to warm the plate thoroughly and re-varnish.



CHAPTER XXI.

GENERAL HINTS.

THE finest negatives are obtained by a full exposure and slow development.

Always save your developer (after using) in a separate bottle for over-exposed plates. It will keep for a day or two, if well stoppered.

The immersion of the plate in a strong alum solution hardens the gelatine and gives clearer shadows.

Always pour the developer back into the graduate before developing a new plate.

If you wish to secure prints from a newly-developed negative in a hurry, soak it in alcohol for five minutes, expelling the water, and it will dry in one third the usual time.

The distance of the object affects the length of exposure materially. Distant hills will photograph in less than one half the time, in the same light, that is required for a portrait ten feet from the lens. This should always be taken into consideration.

CHAPTER XXII.

DEFINITIONS.

A *stock solution* is one that is made up for future use, generally of great strength, and is convenient for preparing diluted solutions for immediate use.

A *saturated solution* is one which will take up no more of the salt. If undissolved crystals remain at the bottom the solution may be presumed to be saturated.

Litmus paper is a soft absorbent paper, colored purple by vegetable infusion. If put in an acid solution it is turned red, and thus becomes a ready test (no pun) for free acids.

After the paper has been reddened by acid it will be again turned purple by immersion in alkali, and furnishes a convenient test for its presence.

Halation. When an interior view includes a window through which a strong light pours, the other objects in the picture being so dark as to require a considerable exposure, the image of the window is

not only blurred by over-exposure but the light extends from it over the plate, forming a *halo* or margin of light around it, and producing an unpleasant effect.

A Ghost. When the image of the sun or other strong light is reflected from a window or other surface, so that it enters the lens, a haze or blur of white is seen in the print, called a "ghost."

Actinometer Tests.—The "actinometer" is a hydrometer for testing density of fluids, having a scale which indicates the number of grains to the fluid ounce. Thus a solution of 50 grains of nitrate of silver to the ounce of water allows the actinometer to sink to the figure 50, and the solution is said to be "fifty grains strong."

CHAPTER XXIII.

NEVER!

Never handle a second plate after fixing a negative without washing the hypo from the fingers.

Never add the *oxalate* to the *iron*, in mixing the ferreous oxalate developer, but vice versa.

Never varnish a plate till the gelatine is thoroughly dry, as it makes it opaque.

Never use more than 1 part of iron to 4 of oxalate, or the iron will deposit on the plate and spoil it.

Never withdraw the plate-holder slide till you are sure the cap is on the lens tube.

Never take a photograph facing the sun, as it makes a "ghost" on the plate and gives an unlighted picture.

Never use a solution warmer than 60° Fahrenheit.

Never use an alkaline solution of oxalate of potash, but add acid till it turns litmus paper red.

Never keep dry plates in a damp place.

Never open the door of your dark room, or light an ordinary lamp, till your plate box is closed.

Never touch the surface of the lens with the fingers.

Never lend a good lens.

What ! never ? No, NEVER!

CHAPTER XXIV.

WEIGHTS AND MEASURES.

APOTHECARIES WEIGHT.

SOLID MEASURE.

20 grains	=	1 scruple	=	20 grains.
3 scruples	=	1 dram	=	60 “
8 drams	=	1 ounce	=	480 “
12 ounces	=	1 pound	=	5760 “

FLUID. Symbol.

60 minims	=	1 fluid dram f.	3
8 drams	=	1 ounce f.	
20 ounces	=	1 pint	O 3
8 pints	=	1 gallon	gall.

The above weights are those usually adopted in formulæ. All chemicals are usually sold by

AVOIRDUPOIS WEIGHT

27 $\frac{11}{32}$ grains	=	1 dram	=	27 $\frac{11}{32}$ grains.
16 drams	=	1 ounce	=	437 $\frac{1}{2}$ “
16 ounces	=	1 pound	=	7000 “

Precious metals are usually sold by

TROY WEIGHT.

24 grains	=	1 pennyweight	=	24 grains.
20 pennyweights	=	1 ounce	=	480 “
12 ounces	=	1 pound	=	5760 “

Note.—An ounce of *metallic* silver contains 480 grains, but an ounce of *nitrate* of silver contains only 437 $\frac{1}{2}$ grains.





